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WORK PLAN
REMOVAL ACTION
NORTH END FORMER DISPOSAL AREA
UNION WIRE ROPE PLANT SITE
KANSAS CITY, MISSOURI

PREPARED FOR

ARMCO INC.
MIDDLETOWN, OHIO
KANSAS CITY, MISSOURI

NOVEMBER 1989

PROJECT NO. 89119



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SUPERFUND RECORDS

REMCOR, INC.
PITTSBURGH, PENNSYLVANIA



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1.0 INTRODUCTION

On behalf of Armco Inc. (Armco), Remcor, Inc. (Remcor) has prepared this work plan to define the procedures to be employed in the conduct of a removal action at the North End former disposal area of the Union Wire Rope (UWR) plant site in Kansas City, Missouri. This removal action will be performed to fulfill Armco's obligations under the terms of the Consent Agreement among Armco; the U.S. Environmental Protection Agency (EPA), Region VII; and the Missouri Department of Natural Resources (DNR). Waste removal activities will occur on property currently owned by Armco, including an area planned for use by the U.S. Army Corps of Engineers (COE) for the rechannelization of the (Big) Blue River. Arrangements for this rechannelization project are such that the City of Kansas City (the City) will acquire this property. Both the COE and the City will be signatory to or state their concurrence with the Consent Agreement.

1.1 PROJECT DEFINITION

Remcor had previously completed a remedial investigation (RI) of the North End former disposal area at the UWR site under contract to Armco. This study concluded that lead-containing materials were deposited together with rubble, debris, and soil within a 2.0-acre area at this location. Some of this lead-bearing waste exhibits the characteristic of extraction procedure (EP) toxicity due to the concentration of lead in its leachate. The RI and subsequent quarterly ground water sampling at the UWR site have also indicated that ground water near the North End former disposal area contains volatile organic compounds (VOCs). The source(s) of the VOCs have not as yet been adequately defined, and further ground water investigation is required. Based on the results of planned additional studies, the need for ground water remediation can be assessed.

1.2 SUMMARY OF REMOVAL ACTION

The removal action at the North End area of the UWR site is comprised of two relatively independent activities:

- Removal of formerly placed wastes
- Additional ground water investigation.

The need for ground water remediation has not been established; if ground water cleanup is deemed necessary, such remediation will be performed outside the current Consent Agreement.

The objectives of waste removal are as follows:

- Eliminate characteristic hazardous wastes from the site by excavation and disposal of these materials in permitted off-site facilities
- Minimize the potential exposure to and releases of contamination from nonhazardous lead-bearing wastes and affected soils by excavation and off-site disposal
- Restore the work area to minimize conflict with the COE's plans for rechannelization of the Blue River
- Restore the waste area as needed to allow future industrial use of those portions of the site not claimed in rechannelization.

The objective of the ground water study is to determine the source(s) and extent of VOC concentrations as a basis for remedial assessment.

1.3 ORGANIZATION OF WORK PLAN

This work plan is organized into five chapters and eight appendices. Following this introduction, Chapter 2.0 presents the results of the RI as the basis for determination of removal action requirements. Appendices A through D provide supplemental information regarding the RI methods and results. Chapter 3.0 presents the plan for excavating and handling the fill materials, and Chapter 4.0 discusses the ground water investigation plan and procedures. Chapter 5.0 presents the project schedule.

The Field Sampling and Analysis Plan (FSAP), which describes procedures for sampling and analysis during both the excavation work and the ground

water study, is included as Appendix E. The Quality Assurance Project Plan (QAPP), which presents QA procedures for sampling and analysis activities as well as data quality objectives, is included as Appendix F. The project-specific Health and Safety Plan (HASP) is provided as Appendix G. Appendix H presents the development of site-specific cleanup standards for lead concentrations in soils.

2.0 REMEDIAL INVESTIGATION

This chapter provides a summary of the RI of the North End area of the UWR plant site. The results of the RI form the basis for the planned removal action.

2.1 BACKGROUND

2.1.1 Site Location and Environmental Setting

2.1.1.1 Site Description

The UWR plant site is located on an approximate 60-acre tract along the south bank of the Blue River in Kansas City, Missouri (Figure 1). Land use in the plant vicinity is industrial and vacant land.

The site is bordered on the west by Kansas City Southern (KCS) railroad lines, beyond which is a former Kerr-McGee Corporation (Kerr-McGee) wood-preserving (pole and railroad tie treating) facility. Manchester Avenue divides the production area from the office building and material storage areas; other industrial facilities also are situated on the eastern side of Manchester Avenue (Figure 2). State Route 78 (23rd Street) defines the approximate southern extent of the operations area.

The North End area consists of approximately 2.5 acres at the extreme northern limits of the property. Its northern, western, and eastern extent is defined by the Blue River, between the KCS railroad and Manchester Avenue bridges. A chain-link fence forms the southern limit (Figure 3).

2.1.1.2 Regional Topography and Drainage

The Kansas City, Missouri region is an area of rolling and plain topography with dendritic streams of mature developmental stage (McCourt, et al., 1917). Stream valleys are wide and flat-bottomed; meandering streams and oxbow lakes are common.

The average discharge of the Blue River near its confluence with the Missouri River is approximately 200 cubic feet per second (cfs) (Waite, 1987). A major portion of the UWR plant site is within the active floodplain of the Blue River; flooding of the plant has been reported on more than seven occasions since 1928 (Zerr, 1981).

2.1.1.3 Regional Geology

The site region is part of the Osage Plains portion of the Interior Plains physiographic province (Emmett, 1985; Anderson, et al., 1979), located midway between the Ozark Plateau and the Great Plains (McCourt, et al., 1917). The geology of the Osage Plains is relatively uncomplicated, dominated by relatively flat-lying sedimentary rocks (dipping 10 to 20 feet per mile to the west-northwest) and unconsolidated alluvial deposits in the valleys (Parizek, et al., 1968).

Figure 4 is a generalized geologic cross section through the area of the UWR plant site. As illustrated in this figure, five geologic units are present in this area (Parizek, et al., 1968):

- Marmaton Group
- Pleasanton Group
- Kansas City Group - Bronson Subgroup
- Kansas City Group - Linn Subgroup
- Blue River Alluvium.

These units are Pennsylvanian in age, except for the alluvium, which is of the Quaternary period.

The oldest bedrock unit of these listed is the Marmaton, which consists of an upper shale, median limestone, and basal sandstone (Anderson, 1979). According to Parizek, et al. (1968), this unit is present at a depth of approximately 100 feet below the ground surface in the area of the UWR plant (Figure 4).

Overlying the Marmaton is the Pleasanton Group, comprised of argillaceous to sandy, micaceous shale. Thin, fossiliferous siltstone beds are

also present in upper portions of the group (Parizek, et al., 1968). This unit is exposed in the vicinity of the Blue River near the site. The upper surface of this unit appears to be at the approximate elevation of Interstate Route 435 to the east of the site, based on visual identification at the time of the site investigation.

The bedrock units lying above the Pleasanton Group consist of the Bronson and Linn subgroups of the Kansas City Group. Both of these members of the Kansas City Group have been removed by erosion at the UWR plant site. The Bronson Group consists of a cyclic sequence of three major limestones separated by shale and clay units. The Linn Subgroup consists of shales, a few persistent limestones, and some thin sandstones.

Locally derived alluvium lines the valley bottom along the Blue River. Near the UWR site, this material is on the order of 30 to 60 feet thick (Parizek, et al., 1968). Based on data provided by exploratory geotechnical drilling performed for the COE in preparation for the Blue River rechannelization project (U.S. Army Corps of Engineers, 1979), the natural alluvial deposits consist primarily of high- and low-plasticity clays (Unified Soil Classification System [USCS] CH and CL). Sandy clays (SC) and poorly graded sands (SP) exist at depth, buried by the clayey and silty surface materials. COE borehole data show that ground water levels in boreholes will rise to approximately 10 feet below grade. Shale bedrock is at a depth of 60 feet.

2.1.1.4 Regional Hydrogeology

Aquifers of the site region may occur in either bedrock or unconsolidated materials. Bedrock aquifers typically consist of sandstones, where permeability is controlled by primary porosity, or within limestones, where permeability is generally a function of the density and interconnection of fractures. Typical yields from domestic wells tapping the bedrock aquifer(s) range to less than 20 gallons per minute (gpm) (Imes, 1987). Near major rivers, these bedrock aquifers are not commonly used for domestic, industrial, or municipal water supplies.

Unconsolidated glacial drift formations are relatively unimportant as aquifers in the Kansas City area. These drift deposits are typically thin mantles of silty clay material that transmit very little water.

Deposits of alluvium along major rivers (e.g., Missouri River) are widely used for water supply by both industry and individuals. Wells developed in these deposits commonly yield on the order of several thousand gpm (Emmett, 1985). Ground water is typically encountered at shallow depths (less than 20 feet) with flow directions toward and in the downstream direction of the alluvial valleys.

Records of the Missouri DNR, Division of Geology and Land Survey, indicate no ground water wells are located within one mile of the UWR plant site. The DNR data base for water wells includes all wells drilled since 1986; prior to 1986, submittal of well logs by drillers was optional.

2.1.2 Plant History

In 1917, Black Steel & Wire Company purchased 12.5 acres of land along the Blue River and subsequently constructed a wire and rope mill at the site of the current UWR plant (Zerr, 1981). Originally, the mill was designed to produce 7,500 tons of wire and 5,000 tons of rope annually. The rope was primarily for oil field usage. An oil-fired open hearth furnace and rolling mill were then added to produce rods for drawing.

In 1927, the Black Steel & Wire Company was reorganized as the Union Wire Rope Co., and the new organization immediately initiated a major overhaul of the plant. The open hearth and rolling mill were dismantled and removed, and other equipment was reconditioned. Plant expansions subsequently occurred, and additional lands were acquired. By 1958, the plant site generally reached its current boundaries.

Armco purchased the Union Wire Rope Co. in 1958. By this time, annual production capacity had increased to 72,000 tons per year with hundreds

of products. Continued upgrading and expansion of facilities occurred since that time.

In April 1988, Armco entered into an agreement with the Wire Corporation of America (Wireco) for future operation of the UWR plant. Under the agreement, Wireco purchased the inventory and equipment at the UWR plant, and Armco retained ownership of the property and physical improvements. Armco erected a fence to restrict access to the North End area and maintains control of this area.

Wireco is leasing the plant from Armco for a period of five years. Disposition of the plant site at that time is undetermined, and Armco may choose to sell the property for other industrial or manufacturing uses.

2.1.3 Plant Operations

The following paragraphs briefly describe the major processes that were used for wire rope manufacturing at the UWR plant at the time of completion of Armco operations. Figure 2 shows the locations of structures associated with these processes.

2.1.3.1 Cleaning

The first step in wire rope manufacturing occurred in the cleaning house. Within this area were located several baths filled with conditioning chemicals:

- Copper sulfate
- Phoscoat (zinc phosphate and phosphoric acid)
- Borax
- Sulfuric acid.

Bundles of steel rod brought to the plant from outside suppliers were first pickled in a hot sulfuric acid bath to remove surface oxidization. Rod bundles were rinsed in a water bath and then dipped in the Phoscoat bath. The Phoscoat acted as a wire drawing lubricant.

The rod was again rinsed and then dipped in a borax bath; the borax lubricated the rod for subsequent wire drawing. Depending on the type of product in which the rod was to be incorporated, the rod bundles may have been dipped in the copper sulfate bath to precondition the rod for subsequent processing.

2.1.3.2 Wire Drawing

The conditioned bundles of rod were then delivered to the wire-drawing building to reduce the diameter in preparation for subsequent winding steps. Within this building, the process equipment drew the rod into wire and rewound the wire onto spools. An alkaline soap powder was applied to lubricate the rod in the drawing process.

2.1.3.3 Patenting and Galvanizing

In the patenting area, the wire was heated in an oven and passed through a molten lead bath. The lead was subsequently removed by passing the wire through a coke wipe. The wire was then coiled and moved for additional processing.

In galvanizing, the wire was pulled through a molten lead bath, scraped, and passed through a bath of hydrochloric acid (HCl). After the acid treatment, the wire passed through a molten zinc bath. The coated wire was then rewound onto spools and moved to further processing.

2.1.3.4 Rope Mill

Within the rope mill the individual strands of wire were wound together in varying combinations to produce the wire rope (cable). An asphaltic material was applied to the strands in the winding process. The rope mill had the capacity to manufacture cable of varying diameters and properties.

2.1.4 Use of the North End Disposal Area

The North End area at the UWR plant site had been used for storage of equipment and materials used in plant operations. In anticipation of

the divestiture of UWR, Armco personnel conducted an environmental audit of the UWR site in Kansas City in the fall of 1987. As part of this inquiry, discussions with cognizant UWR plant personnel suggested that an approximate 1.5- to 2.0-acre area at the North End may have previously been used for disposal of plant wastes. There was concern expressed that waste materials containing hazardous constituents may have been placed with this former disposal area.

The North End area has not been included in Armco's lease of the UWR site to Wireco. This area has been cleared of previously stored equipment and materials and has been fenced to preclude inadvertent access.

2.2 INVESTIGATION METHODS

The principal field investigations of the UWR plant site were conducted during the periods of December 14 through 18, 1987 and January 4 through 9, 1988. Additional site monitoring wells were installed on November 17, 1988. Ground water sampling has been conducted on nine occasions between January 1988 and September 1989. Sampling of soils/waste and ground water pertinent to the evaluation of the North End area has established the data base required to satisfy project objectives.

2.2.1 Sample Collection

The RI involved the collection of samples of various media in several physical settings. Each of these sample types required a specific methodology; the following sections describe the numbers and locations of samples and procedures used for the various media. A comprehensive sampling map illustrating the locations of all samples collected during the RI is provided as Figure 2.

2.2.1.1 Test Pits

At the North End former disposal area, 13 test pits were excavated in eight areas by means of a rubber-tired backhoe. The pits were located such that a representative areal distribution of subsurface samples could be attained. Eleven test pits (i.e., TP-1A through TP-6) were

excavated in six areas along the perimeter of the suspected disposal area; two additional test pits (TP-7 and TP-8) were located in the interior of the site (Figure 3). Test pits were excavated to depths ranging from 5 to 10 feet. Each pit was excavated downward into material visibly identifiable as native (nonfill) soil. The depths of the test pits were not limited by the presence of ground water, as ground water was not encountered in the test pitting.

During the excavation of each test pit, the Remcor field geologist compiled a geologic log of subsurface conditions encountered (Appendix A). These logs recorded field observations and measurements, including the presence and location of the various fill materials and indigenous soils. The test pit excavations were routinely surveyed using an organic vapor analyzer (OVA); no positive readings were reported.

A total of 21 soil and fill material samples were collected from the test pits for laboratory analysis. These samples were collected by either of two methods:

- Scraping the sample from the pit wall
- Collection from the backhoe bucket.

In either case, samples were collected by use of stainless steel spatulas. The spatulas were decontaminated prior to each use. In some cases, individual soil samples were composited from the same depth across the test pit by blending collected materials in a stainless steel mixing bowl. The mixing bowls were also decontaminated prior to each use. Upon collection, test pit soil samples were placed and sealed in clean 250-milliliter (ml) clear glass bottles with plastic screw caps. Where samples were to be analyzed for priority pollutant VOCs, the bottles were prepared by the analyzing laboratory by adding approximately 100 ml of chromatographic-grade methanol. TFE-fluorocarbon-lined screw caps were used for VOC samples.

2.2.1.2 Test Borings and Well Borings

Soil samples from borings were collected with steam cleaned split-spoon samplers by means of a small geotechnical drill rig using hollow-stem augers. Samples were collected via 2-inch split-spoon driven by a 140-pound hammer falling freely through 30 inches, in accordance with the American Society for Testing and Materials (ASTM) Method D 1586-74, and standard penetration resistance was recorded.

Test Borings TB-7 and TB-8 were drilled and sampled to a depth of 5 feet around the bulk HCl storage tank in the North End area. Test borings in the area of the acid rinsewater equalization tank (i.e., TB-9, TB-10, and TB-11) were drilled and sampled to a depth of 17 feet; this depth is 2 feet below the tank invert. None of these borings encountered ground water.

Boring logs for each of the test borings and monitoring wells were developed by the supervising Remcor geologist/engineer and are included as Appendix B. Each soil sample collected is noted on these logs. Upon collection, each sample was contained in the laboratory-supplied bottles and sealed for shipment to the analytical laboratory.

2.2.1.3 Ground Water Monitoring Well Installation

Ten monitoring wells have been installed at the UWR plant (Figure 2):

- Four wells (MW-1, MW-2, MW-3, and MW-3A) are located at the North End of the facility
- Five wells (MW-4 through MW-7 and MW-9) are located in the operations area of the plant site, generally upgradient of the North End
- MW-8 was installed as an on-site background well.

Each of these wells was constructed in the uppermost continuous water-bearing zone beneath the site. Typically, wells were drilled to a depth of 20 to 25 feet.

Each well was drilled by a small geotechnical drill rig using hollow-stem augers and logged by a Remcor geologist/engineer. Boring logs were developed during the drilling of each well and are included in Appendix B; split-spoon samples were collected at each well to provide geologic and hydrogeologic data.

To reduce the potential for cross contamination, auger flights were steam cleaned prior to use at each well. Split spoons were likewise decontaminated. Additional measures to reduce cross contamination included the steaming of polyvinyl chloride (PVC) well materials not contained in factory-sealed boxes prior to use.

Each well was constructed of two-inch (inside diameter) flush-joint PVC riser and factory-slotted 0.010-inch screen. Wells outside the buildings were constructed with a six-inch diameter protective steel casing with lockable cap, while wells inside the buildings were constructed with flush, floor-mount covers and water-tight lockable caps attached to the PVC riser. Well construction diagrams were completed for each well, detailing the placement of screen, riser, sand pack, and seal. These diagrams are included as Appendix C.

Ground water samples were collected from each well only after the well had been developed by bailing until suspended fines had been removed. Prior to collection of each ground water sample, the well was purged of three to five well volumes. Collection of the ground water samples was by steam-cleaned stainless steel bailers.

An elevation survey of each well was conducted by a registered land surveyor and referenced to a benchmark at the Manchester Street Bridge. The elevation of each measuring point at each well was determined to the nearest 0.01 foot, as were the elevations of the stage gage in the Blue River and two surface water reference points on the Manchester Street Bridge. Appendix C (Table C-1) includes tabulated survey information for these wells.

2.2.3 Sample Handling and Documentation

Upon collection of each sample, the following information was recorded on the label preaffixed to the sample bottle:

- Project identification
- Sample number
- Time and date of collection
- Sample type
- Collector's initials.

Sample bottles were sealed with plastic tape, placed in cartons, and packaged for shipment.

2.2.3.1 Sample Nomenclature

Each sample was designated with a 9- to 11-digit sample number to facilitate tracking. The primary three-character code ("RAU") was used for all samples to refer to the specific Remcor project. (For simplicity, this code is deleted in subsequent references to sample numbers in this report.) The following two digits refer to the location and media sampled:

- MS - Soils from monitoring well borings
- MW - Ground water (monitoring wells)
- TB - Test boring soils
- TP - Test pit soils.

Following the media descriptor is the three-digit sequence number referring to either sample number, or specific boring, well, or test pit number. When this field includes the letter "R", this designates a replicate sample. The final digits of the sample number refer to the sampling round. In the case of subsurface soils from specific depths at a single location, the final digit is followed by a letter, which indicates the depth or number of samples collected from a unique test pit or boring.

2.2.3.2 Sample Documentation

At the end of each day of field work, chain-of-custody forms were completed for the collected samples. These forms were then packed with the

samples for shipment to the laboratory. Delivery was either directly by Remcor personnel or overnight courier. Chain-of-custody protocols were followed throughout the sample collection and shipping sequence.

Sample log books and/or well purging sheets were completed for the sampling efforts providing the details of sample collection, techniques, and locations. These logs have been retained by Remcor as permanent records of the sampling effort.

2.2.4 Sampling Equipment Decontamination

Appropriate precautions were taken in the field to reduce the possibility of cross-contamination of samples. Contact surfaces of sampling equipment used for all sampling were decontaminated prior to each use.

Sampling equipment included stainless steel spatulas, stainless steel mixing bowls, split-spoon samplers, stainless steel bailers, and miscellaneous hand tools. The primary method by which sampling tools were decontaminated was the following:

- Wash with solution of laboratory grade, phosphate free detergent (Liqui-Nox[™]) and water
- Hexane rinse
- Distilled water rinse
- Air dry.

Larger pieces of sampling equipment, such as the split spoons, stainless steel bailers, and hollow-stem augers, were decontaminated by use of a high-pressure steam washer. This decontamination process was also applied to the backhoe used to excavate the test pits.

2.2.5 Laboratory Analysis Protocols

Analytical support for this investigation was provided by Antech Ltd. Laboratory Services (Antech) of Export, Pennsylvania. The selection of Antech as the analytical laboratory was based on Armco's and Remcor's

past experience with Antech and the determination that Data Quality (DQ) Level III was appropriate for the waste, soil, and ground water testing. The uses of the data for site characterization and alternatives evaluation are consistent with DQ Level III in accordance with EPA guidance.

2.2.5.1 Testing Methods

Preparation and analysis of solid and aqueous samples were performed in accordance with the protocols specified in Table 1. Both digestion/extraction and analytical protocols are noted where appropriate.

2.2.5.2 Quality Control Procedures and Data Validation

Remcor field personnel ensured strict adherence to the described chain-of-custody and sample documentation procedures throughout the course of field sample collection and transport to the laboratories. Preservation requirements were met for all samples in accordance with the analytical protocols specified in Table 1.

Laboratory quality control (QC) procedures included preparation and analysis of duplicate samples for each group of samples analyzed in each medium. Laboratory duplicate analyses are provided in the analytical data summary tables. In addition, field replicates were submitted as blind samples to provide an additional check on the quality of the laboratory data.

Matrix spikes and matrix spike duplicates, as well as National Bureau of Standards (NBS) and EPA-certified method blanks were also analyzed by Antech in accordance with requirements of the analytical protocols. Spike recoveries and method blank tests of instrument performance were within acceptable limits during analyses of samples from this project.

Field and trip blanks were collected as a quality check on field sample collection equipment and procedures, as well as on laboratory analyses.

The following samples were collected as field replicates:

- Soil and Fill Materials:
 - TP-07A-1A//TP-07A-1B
 - MS-006-1A//MS-006-1B
- Ground Water:
 - MW-001-01//MW-001A-01
 - MW-006-04//MW-006A-04
 - MW-008-05//MW-008A-05
 - MW-006-06//MW-006R-06
 - MW-006-07//MW-006R-07
 - MW-006-08//MW-006R-08
 - MW-006-09//MW-006R-09.

Replicate analyses of TP-07A-1A and TP-07A-1B exhibited acceptable agreement regarding EP toxicity metals and total lead; however, analyses for total zinc and oil and grease were not in good agreement. Matrix inhomogeneity may have contributed to the difficulty in extracting more comparable samples for analysis. Replicate analyses of MS-006-1A and MS-006-1B showed excellent agreement for pH, lime requirement, total copper, and total lead. Total zinc analyses showed acceptable reproducibility. Excellent agreement has generally been obtained in the seven sets of replicate samples of ground water taken from Points MW-001 and MW-006.

Nine field and trip blank samples for ground water have been submitted for analysis. Blank media were not readily available for soils and fill encountered during the field sampling. With minor exceptions, contaminants of concern at the UWR site have not been found in the blank samples above method detection limits. Methylene chloride was found in the trip blank for the May 1989 round of ground water monitoring.

Tables 2 and 3 and Appendix D report laboratory duplicate analyses performed by Antech. Five of 17 test pit soil samples were analyzed in duplicate for total lead. Variations between duplicates were generally 20 to 30 percent of the mean; however, in the case of TP-01C-1, the variation between duplicates exceeded 40 percent of the mean. Three samples were subjected to duplicate analyses for total zinc, with excellent

agreement between duplicates. A single sample analyzed in duplicate for total cyanides evidenced good agreement. Poor agreement was noted in two samples analyzed in duplicate for oil and grease. Variations between samples exceeded 70 percent of the mean value. Two other samples were analyzed in duplicate for oil and grease, with concentrations near the detection limit; duplicate analyses confirmed the general absence of oil and grease in these samples. Good agreement was also found between three separate test pit soil samples analyzed in duplicate for EP toxicity lead. The 1:1 pH measurements in subsoils at the HCl tank and the acid rinsewater equalization tank were confirmed by Antech through performing duplicate analyses on two soil samples taken from these areas. Duplicate analysis of lead in three ground water samples showed excellent agreement.

2.2.6 Aerial Photography Review

Remcor examined archival aerial photographs to provide insight into the time frame and methods of waste disposal at the North End. Descriptions of the photographs reviewed in this effort follow:

- Photograph 1 - Oblique aerial photograph of the UWR site taken in 1953
- Photograph 2 - Vertical black-and-white photograph, enlarged to 1 inch = 100 foot scale, taken in 1957
- Photograph 3 - Vertical black-and-white photograph, enlarged to 1 inch = 100 foot scale, taken in 1969
- Photograph (Set) 4 - Vertical stereographic black-and-white photographs, 1 inch = 200 foot scale, taken in 1973
- Photograph (Set) 5 - Vertical stereographic color photographs, 1 inch = 200 foot scale, taken in 1977
- Photograph 6 - Vertical black-and-white photograph, enlarged to 1 inch = 200 foot scale, taken in 1979.

A copy of Photograph 1 was found in "The Union Wire Rope Story," an unpublished history of the facility (Zerr, 1981). This report was written by C. M. Zerr, who held various engineering and administrative positions

at the UWR plant from 1934 through 1971. Photographs 2 through 6 were provided by the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service (ASCS) in Salt Lake City, Utah.

Photograph 1, which was reviewed as a photocopy and somewhat lacks resolution, seems to show disposal of solid materials in the central to western portion of the North End area in 1953. The disposal area, which covers perhaps 30 to 40 percent of the site, appears to extend to the east to an escarpment. The eastern portion of the site appears to be wooded.

Photograph 2 shows apparent disposal activity in the central and western portion of the North End area. The eastern escarpment identified in the 1953 photograph remains visible, although some more-limited disposal east of this feature may have occurred. It is estimated that 60 percent of the present North End area (in plan) was filled prior to 1957. The northeastern portions of the site were not yet in use as disposal areas. The western limits of the filled area are definable by the presence of a trench parallel to the railroad. The photograph also indicates the presence of a few mature trees along the right bank of the Blue River.

Photograph 3 shows that, by 1969, the placement of solid materials in the North End area had extended to the east and that the entire two-acre area had become relatively level to plant grade. The formerly identified eastern escarpment is not visible in this photograph, but a steep bank along the right bank of the Blue River can be seen. By inspection of this photograph, it appears that nearly all of the North End area had been used by 1969, and western portions of the site were being used to store equipment and/or materials. The mature trees that were present in the 1957 photograph have been removed.

The stereo pair of photographs from 1973 (Photograph [Set] 4) indicate that all filling in the North End former disposal area was completed by 1973. A transparent copy of the current site map was overlaid on these

photographs and showed that the site topography has not changed significantly since 1973. Apparent topographic changes between 1969 and 1973 were limited to the northeast corner of the site. The area was in use for product and/or materials storage at the time of the 1973 photographs, and two pipe drainage ditches are clearly entrenched at the North End. Topographic relief also clearly indicates the presence of western and eastern ditches that bound the site. The eastern portions of the site are vegetated, and current fixtures such as the acid rinse-water and aboveground tanks are absent.

In the 1977 and 1979 photographs (Photographs 5 and 6), the character of the North End area remains generally unchanged from 1973. The ground surface is light-colored, evidencing a gravel surface, and the area was being used for surface storage of wire spools and other equipment. The acid rinsewater equalization tank is clearly visible at its present location (Figure 3), and site topography reflects current conditions.

2.3 INVESTIGATION RESULTS

2.3.1 Subsurface Conditions

Subsurface conditions across the site have been determined through the test pit excavation and investigative drilling. The encountered subsurface soils and fill and ground water conditions are described in the following sections.

2.3.1.1 Soils and Fill Materials

The UWR site is located within a meander loop of the Blue River and resultant geologic floodplain. Subsurface materials are classified as Quaternary Alluvium of the Blue River. Holocene flood events have typically deposited silt and clay materials with minor amounts of fine sand. In general, the silt and clay sequence coarsens with depth resulting in a more-permeable lower zone. Abrupt contacts are rare in the sequence;

contacts tend to be gradational. The unconsolidated alluvium is underlain by shale, whose upper surface is at an elevation of 684 feet above mean sea level (ft-msl), based on data from COE Boring D-28. Boring D-28 was located in the northern portion of the UWR site.

In one well boring, MW-8, a green glauconitic fine sand with glauconitic clay lenses and traces of plant fragments was logged at a depth of 19.5 feet. This material represents the basal unconsolidated material encountered at UWR site. This unit was not encountered at any other boring at the site but is presumed to exist at depths exceeding that of other borings.

Overlying the glauconitic unit is a dark gray silt-sand mixture with plant fragments. This unit is water-bearing at any point it was encountered at the site.

Overlying this silt-sand unit is a gradational contact with a finer unit that is dark gray silt with plant fragments. This unit, when soft, transmits water to monitoring wells. The overlying clayey silt, silty clay, and clay units are aquitard units. These units typically occupy the upper 15 to 20 feet of the stratigraphic column at the site. In some areas, particularly in the southern portions of the UWR plant site, this unit acts as a confining layer.

A gray to brown silty clay of alluvial origin was found in the test pit excavations to be the native material underlying the fill at the North End. This finding is consistent with information reported by the COE from geotechnical investigations associated with the Blue River rechannelization project and other site borings. These soils would be expected to exhibit a relatively low permeability.

Based on observations made during test pit excavation and from the review of historical aerial photographs, fill materials at the North End former disposal area were apparently end-dumped atop the ground surface.

This dumping progressed generally from the southwest to the northeast, filling a low-lying area along the right bank of the Blue River. Presently, a relatively steep slope with 8 to 12 feet of total relief defines the northern limit of the fill area (Figure 3).

The fill materials were found to include a black dust and fine scale material. Construction debris (e.g., bricks and rubble) scrap wire product, and miscellaneous plant debris were also encountered. The thickness of fill ranges to 8.5 feet on the western side of the site (Appendix A, Log of TP-7; Figure 3), but is typically on the order of 4 feet. At its deepest point, the lower fill/waste horizon is at approximate Elevation 740 ft-msl. Visibly identifiable wastes are generally covered with 6 to 12 inches of gravel and soil. Based on data recorded in test pit logs (Appendix A), Remcor estimates a total quantity of fill in the North End former disposal area of 12,000 cubic yards (yd³). The fill encompasses a plan area estimated at 85,000 square feet (ft²) (2.0 acres).

The black, lead-bearing dust was likely generated in the patenting and galvanizing operations and collected in containers along with other paint trash and debris. It appears that such containers were then emptied in the North End area.

Particular attention was paid for the presence of drums in the test pits. Although numerous drum lids were unearthed, only two drums were located. Based on their appearance and contents, it is believed that both were used as trash receptacles prior to being buried at the disposal area. There are no records to indicate that spend chlorinated solvents, paint wastes, or similar materials were routinely disposed in the North End area.

2.3.1.2 Ground Water

Observations and data collection activities conducted at the UWR site allow for an assessment of ground water flow conditions. The following

sections describe the hydraulic characteristics of the uppermost water-bearing zone.

Ground water is contained within the soft silt and silt-sand units at the site. The upper, finer deposits tend to be aquitard materials, confining the aquifer in places. Based on the encountered lithology and the fact that developed wells cannot be bailed dry by hand during purging, the hydraulic conductivity of the uppermost water-bearing zone is estimated to be in the range of 1×10^{-4} to 1×10^{-3} centimeter per second (cm/sec) (Freeze and Cherry, 1980). The permeability is expected to increase with depth.

The saturated thickness of the uppermost water-bearing zone is not well defined. Based on the depth to shale in an on-site COE boring, a saturated thickness of 50 to 60 feet is considered the probable maximum.

The uppermost water-bearing zone is a partially confined aquifer whose recharge area appears to be southwest of the plant and perhaps, to some degree, from leakage through the overlying stiff clay. Ground water discharge is apparently to the Blue River.

Ground water was typically encountered in borings between 15 and 20 feet below grade and, in some wells, rose to water levels as high as 7 feet below grade. The compilation of ground water elevations at the time of drilling MW-1, MW-2, and MW-3 showed the water table surface at an elevation of approximately 734 ft-msl near the Blue River; the stage of the Blue River was approximately 731 ft-msl at the same time. Typical ground water levels are shown in Figure 5. This figure shows that the general direction of ground water flow is toward the north-northeast. The mapped ground water contours indicate that ground water discharge to be in the direction of the Blue River (north).

Appendix C (Table C-2) includes the tabulation of ground water elevation data collected over the monitoring period of January 1988 through

September 1989. Ground water elevations varied over the period, but hydraulic gradients and flow directions remained generally consistent.

The average hydraulic gradient at the UWR site is in the range of 0.010 to 0.020 foot per foot (ft/ft). In the North End area, hydraulic gradients for discharges to the Blue River were estimated from water levels in wells and the stage of the Blue River; these gradients are in the range of 0.011 to 0.047 ft/ft. These gradients represent discharge zone conditions and tend to be higher than the average gradients across the site.

Based on the described hydraulic conditions, the discharge of ground water from the uppermost water-bearing zone to the Blue River was evaluated using Darcy's Law:

$$Q = K A dh/dl$$

where:

Q = ground water discharge (gallons per day [gpd])

K = aquifer hydraulic conductivity (gallons per day per square foot [gpd/ft²])

A = area of flow (ft²)

dh/dl = hydraulic gradient (ft/ft).

Calculations of ground water flow across the site indicate values in the range of 16,000 to 42,000 gpd.

2.3.2 Analytical Results

The following sections present the results of chemical analyses of soils, fill materials, and ground water at the UWR plant site. Laboratory analyses data for soils and fill materials are presented in Tables 2 and 3. Table 4 is a summary of ground water analysis data; Appendix D tables provide a full reporting of ground water monitoring data through September 1989.

2.3.2.1 Soils and Fill Materials

Twenty-one soil samples were submitted to the laboratory for chemical analyses of the soil and fill materials at the North End area. Seventeen representative samples of soil and fill material were analyzed for the following:

- Total lead
- Total zinc
- EP toxicity metals
- Total cyanide
- Oil and grease.

One sample was analyzed for EP toxicity metals, total cyanides, and oil and grease. Three samples were analyzed for priority pollutant VOCs. Table 2 is a summary of the laboratory analysis results.

As indicated in Table 2, the black dust and scale-type waste materials are lead-bearing, with total lead concentrations ranging from 100 to 130,000 micrograms per gram ($\mu\text{g/g}$). Total zinc concentrations range from about 60 to 4,300 $\mu\text{g/g}$. Two black dust samples (i.e., TP-2A-1C and TP-3B-1) were found to exhibit the characteristic of EP toxicity; the lead content in their leachates exceeded 5.0 milligrams per liter (mg/l). None of the other seven metals analyzed in the EP toxicity leachate (i.e., arsenic, barium, cadmium, chromium, mercury, selenium, and silver) was detected.

The only sample in which cyanide was detected (minimum detection level of 1 $\mu\text{g/g}$) was a sample of a white sand-like waste, which was collected from Test Pit TP-8. This sample contained 10 and 13 $\mu\text{g/g}$ total cyanides in duplicate analyses. Oil and grease contents of the fill materials ranged from less than 50 to 4,900 $\mu\text{g/g}$. No priority VOCs were detected in these analyzed samples.

Soil materials showed much reduced total lead and zinc levels and no detectable metals in EP toxicity leachate. Cyanides were likewise not detected. Oil and grease concentration ranged from less than 50 to 160 $\mu\text{g/g}$.

In addition to the samples collected from test pits within the former disposal area at the North End, soil testing was performed in the vicinity of the HCl storage and acid rinsewater equalization tanks (Table 3). These tanks are located within the North End study area.

Shallow borings were advanced to retrieve near-surface soil samples in the areas of the HCl tank area (Figure 3). Four samples, taken at depths ranging to five feet, were collected in the bulk HCl storage tank area. Soil samples were submitted to the laboratory for pH analysis; soil samples showing a depressed pH were also analyzed for their lime requirement.

In the vicinity of the bulk HCl tank, the pH of soil samples ranged from pH 7.50 to 11.80 (Table 3). These neutral to alkaline conditions may be related to the fact that the soils of the area are generally limestone-derived and that limestone has been placed at the surface near the tank to mitigate the effects of any spillage.

In the vicinity of the acid rinsewater equalization tank (Figure 3), three borings were advanced to a depth of 17 feet for the collection of subsurface soil samples. Samples were collected from Borings TB-9, TB-10, and TB-11 at depths of 11.0 to 11.5, 14.5 to 15.0, and 16.5 to 17.0 feet each. Each sample was submitted for analysis of pH as an indicator potential of acid rinsewater leakage; samples exhibiting a depressed pH were also analyzed for their lime requirement.

During the drilling of each of these borings, particular attention was paid for the presence of ground water. Upon its completion, Boring TB-11 was permitted to stand open for over 48 hours and was found to remain dry. Monitoring Well MW-1 was drilled 140 feet east-southeast of TB-11 and encountered confined water at 19 feet (which rose to a level of 15 feet in the well). This indicates that the soil samples collected at Test Borings TB-9 through TB-11 were of an aquitard material.

The results of pH and selected lime requirement analyses are included in Table 3. These results indicate that the pH of the soil tends to decrease with depth. The median pH values of the three horizons are as follows:

- 11.0 to 11.5 feet - pH 8.2
- 14.5 to 15.0 feet - pH 7.9
- 16.5 to 17.0 feet - pH 6.5.

Depth-pH relationships are not consistent among the three borings, however, and lime requirements are minimal. Leakage from this tank, if it ever occurred, has not significantly affected local soils.

2.3.2.2 Ground Water

Table 4 provides a summary of the analytical data developed from the ground water monitoring conducted during the period of January 1988 through September 1989. Appendix D includes all such monitoring data and statistical summaries of the developed data.

As indicated in Table 4, the general chemistry analysis of ground water samples taken at the UWR plant site included the determination of pH, specific conductance, and alkalinity. These parameters are reliable indicators of whether the ground water has been affected by plant or local operations.

The pH of ground water across the site has ranged between pH 6.0 and 7.9 (Table 4) during the period of record, January 1988 through September 1989. In areas where the pH is in the lower portion of this range, the alkalinity is also lower than alkalinities of waters with higher pH values. The buffering capacity of ground water in certain operations areas may have been reduced, but residual capacity remains. Site-wide seasonal fluctuations in ground water pH have been distinctive, with lower pH values corresponding to periods of lower water levels. The range of pH values in any single sampling round has never exceeded 1.0 standard unit. During the drought conditions of the summer of 1988, pH values in

most wells were found to decline to their lowest levels. Samples collected after prolonged heavy rains and high ground water levels (September 1989) showed the highest levels. Variances in pH are more likely influenced by seasonal fluctuations of water table elevations within the predominantly limestone-derived alluvium and by recharge events than by waste acid disposal or other industrial influence.

The specific conductances at Wells MW-3, MW-3A, and MW-8 have ranged from 580 to 1,000 micromhos per centimeter ($\mu\text{mhos/cm}$), apparently representative of background conditions with respect to inorganic constituents. At Well MW-2, which is downgradient of various plant operations, the specific conductance of the ground water ranges as high as 5,000 $\mu\text{mhos/cm}$.

Background lead concentrations are on the order of less than 0.001 to 0.008 mg/l. Total lead levels at the North End wells have ranged from less than 0.001 to 0.19 with mean levels (\pm the standard deviation) as follows (mg/l):

- MW-1 : 0.027 \pm 0.052
- MW-2 : 0.011 \pm 0.014
- MW-3 : 0.010 \pm 0.007
- MW-3A : 0.004 \pm 0.004.

All of these data are for total (nonfiltered) lead concentrations in ground water. Analyses of the samples collected in September 1989 showed no detectable dissolved lead in ground water at these wells.

None of these mean lead concentration in ground water exceeds the primary drinking water standard of 0.050 mg/l. Lead levels in ground water in the plant operations area vary significantly based on the locations of the samples. Individual high concentrations reported from sampling events have not, however, been confirmed in the more-recent sampling (Appendix D). The latest four rounds of ground water monitoring (20 total well samples) indicate total lead concentrations ranging from 0.003 to 0.11 mg/l in the plant operations area. The arithmetic mean

concentration is 0.027 mg/l. Dissolved lead analyses in September 1989 typically showed nondetectable levels with a maximum value (at MW-4) of 0.012 mg/l.

The background zinc level is taken as 0.03 mg/l based on the MW-8 analysis (Table 4). This background level is exceeded in the samples from the North End wells. None of these waters, however, exhibited a zinc level that approaches the secondary drinking water standard (because of organoleptic properties) of 5.0 mg/l. Copper was also detected in the ground water at the North End in concentrations above background levels. None of these concentrations, however, exceeded the proposed Recommended Maximum Contaminant Level (RMCL) of 1.3 mg/l in drinking water.

Certain priority volatile organics were detected in ground water samples from Wells MW-1, MW-3, and MW-3A at the North End. 1,1,1-trichloroethane (TCA) and its degradation products (e.g., 1,1-dichloroethane [DCA] and chloroethane) and 1,1-dichloroethylene (1,1-DCE) represent the primary compounds found. Trichloroethylene (TCE); tetra- (or per-) chloroethylene (PCE); trans-1,2-dichloroethylene (1,2-DCE); and vinyl chloride have also been detected.

TCA was found at concentrations ranging to 820 micrograms per liter ($\mu\text{g/l}$) at MW-1; the EPA has established a RMCL for TCA in drinking water at 200 $\mu\text{g/l}$. The RMCL for 1,1-DCE is 7.0 $\mu\text{g/l}$; concentrations found in MW-1 and MW-3 ranged to 200 and 3,400 $\mu\text{g/l}$, respectively. The peak 1,1-DCE recorded at Well MW-3 was not repeated in more-recent sampling. No RMCLs have been proposed for DCA or chloroethane.

2.3.3 Data Evaluation

2.3.3.1 North End Soils and Fill Materials

Results of the field and laboratory studies indicate that lead-bearing dusts have been disposed at the North End area of the UWR plant site. Remcor estimates that approximately 33 percent of the total volume of

fill (i.e., 4,000 yd³) is comprised of lead-bearing dusts and dusts mixed with soil and debris.

Comparisons of EP toxicity versus total lead levels in all materials sampled at the North End indicates a statistically significant correlation. Nonlinear regression analysis yields the following empirical relationship (Figure 6):

$$E = 0.0039T^{0.63}$$

$$r = 0.823$$

where:

E = lead concentration in EP toxicity leachate, mg/l

T = total lead concentration, $\mu\text{g/g}$.

r = correlation coefficient.

From this relationship, it is inferred that the lead present in the dust is in a relatively insoluble form (e.g., elemental lead, lead phosphate); materials averaging a total lead concentration of about 80,000 $\mu\text{g/g}$ would be expected to exhibit an average EP toxicity value of 5.0 mg/l. Statistical evaluation of this relationship indicates a 95-percent probability that any material containing less than 3,300 $\mu\text{g/g}$ total lead will not be EP toxic for lead. On this basis, Remcor estimates that perhaps 25 percent of the total volume of lead-bearing dust and dusts mixed with soil and debris (i.e., 1,500 yd³) would exhibit the characteristic of EP toxicity for lead.

Where not mixed with dusts, samples of soil materials show low (less than 100 $\mu\text{g/g}$) total lead levels and no detectable lead in their EP toxicity leachate. The lead contamination is confined to the waste disposal horizon and has not significantly affected underlying soils.

Total zinc concentrations somewhat track total lead concentrations (Figure 6), but several exceptions are noted (e.g., Samples TP-04B-1, TP-08A-C). This relationship suggests that the fill materials include



mixtures of different types of dusts, each comprised of varying proportions of lead and zinc. Soil materials show zinc levels proportionally higher than corresponding lead levels, as compared to respective levels in dusts.

Nonlinear regression analysis of the lead and zinc data (Figure 6) provides the following relationship:

$$Z = 35.8 T^{0.38}$$

$$r = 0.641$$

where Z = total zinc concentration, $\mu\text{g/g}$.

By this equation, wastes and soil/waste mixtures containing 3,300 $\mu\text{g/g}$ total lead would be expected to average 780 $\mu\text{g/g}$ zinc.

Except for one sample of a white sand-like waste, cyanides were not found in the encountered soil or fill materials. There are no regulatory standards for "acceptable" cyanide levels in soils applicable to the UWR site; a total cyanide concentration of 20 $\mu\text{g/g}$ is commonly used as an action level for further investigation and/or cleanup.

Oil and grease levels in soils and fill materials were found to range to a maximum of 4,900 $\mu\text{g/g}$. This concentration (0.49 percent) is considerably lower than the Missouri DNR threshold of 10 percent used to define hazardous wastes (10 Code of State Regulations [CSR] Section 25).

2.3.3.2 Ground Water

Localized ground water contamination has been identified at the UWR plant site as compared to drinking water standards or advisories. Wells at the North End show lead levels slightly elevated, over background, but within primary drinking water standards. Certain volatile chlorocarbons (e.g., TCA and 1,1-DCE) have been found in MW-1, MW-3, and MW-3A.

The sources of this ground water VOC contamination are not well defined. While former site operations may be suspected, certain patterns in the data suggest that the VOC concentrations observed in Wells MW-1 and MW-3 could, at least in part, represent the trailing edge of a contaminant plume that passed through the UWR site.

Well MW-4 is about 250 feet upgradient of MW-1 and shows the presence of TCA, DCA, and 1,1-DCE. In MW-4, the concentrations of these compounds are about 3 to 20 percent of those in MW-1; TCE and PCE have not been detected in MW-4. Similarly, Well MW-3A is about 80 feet upgradient of MW-3. In the four sampling rounds for which data are available from both wells, Well MW-3A showed 30 to more than 90 percent lower total VOCs than at Well MW-3.

3.0 WASTE REMOVAL PLAN

Waste removal operations at the North End former disposal area involve exhumation of buried waste materials, sorting and staging of the excavated materials, and loading contaminated materials into vehicles for off-site waste disposition. All work will be performed in strict compliance with this approved work plan as it is incorporated into the Consent Agreement. The plan presents a sequential material handling scheme that includes excavation, sorting, staging, sampling, testing, waste disposal, and backfilling.

3.1 MOBILIZATION AND SITE SETUP

3.1.1 Mobilization

Remcor will mobilize the necessary personnel, equipment, and materials to the North End former disposal area to conduct the waste removal operation. Needed equipment includes heavy earthmoving machinery (e.g., hydraulic excavator [backhoe], loader, bulldozer), a personnel decontamination facility, and a tool storage trailer. Other mobilization activities include procurement of required materials (e.g., erosion and sedimentation control materials), temporary removal of the chain-link fence along the southern limit of excavation, and construction of a temporary barricade to replace the fence.

3.1.2 Site Survey

A topographic survey of the North End former disposal area will be prepared to establish preconstruction grades and planned limits of excavation. This survey will be performed during site mobilization.

The horizontal extent of planned waste removal is based on the results of observations made during test pit excavation and subsequent laboratory analyses. Review of archival aerial photographs corroborate the results of on-site test pitting. In the review of these photographs (Section 2.2.6), no suspected waste disposal activities were observed outside the planned removal area.

In the survey, the area will be divided into 40-foot wide zones as shown in Figure 7, and survey measurements will be recorded on 40-foot (maximum) centers. The KCS railroad lines to the west and corners of plant buildings will be used for horizontal control. The 40-foot zones represent the excavation sequence work limits. The limits of excavation will be identified initially, and controls will be established to allow documentation of excavation quantities during construction.

With the assistance of Armco and Wireco plant personnel, underground utilities that could be potentially affected by excavation activities will be identified during the site survey. As necessary and appropriate, local utility companies will be contacted to verify the presence and/or location(s) of such utilities.

3.1.3 Site Security and Access

To facilitate exhumation of buried waste, the existing chain-link fence will be removed and replaced with a temporary barricade along the southern perimeter of the North End former disposal area. This work limit will be cordoned off with fencing or tape and warning signs will be erected to preclude inadvertent human intrusion. Access along the remainder of the work area perimeter is effectively controlled by natural/topographic barriers, including the Blue River. No additional physical facilities/barriers for site security are considered necessary during waste removal operations.

Access to the excavation work area will be controlled by the same procedures used to control access to the UWR plant site as part of normal plant procedures. Check-in and check-out procedures are administered by security guards at all plant entrances, including the northern Manchester Avenue entrance located adjacent to the excavation work area. Unauthorized personnel will not be permitted in the work area during or after work hours.

Project-related traffic will use the northern Manchester Avenue entrance for both site ingress and egress. This entrance is located immediately adjacent to the work area. Use of this entrance will allow trucks and heavy equipment easy access to the work area and will not create any additional traffic flow within the active plant areas that would disturb normal operations.

3.1.4 Health and Safety

Construction activities for the removal of the lead-contaminated materials involve work in a potentially hazardous environment. Remcor has designated worker health and safety protection requirements; Appendix G presents the site HASP. The health and safety procedures identified in the site HASP will be strictly followed throughout the conduct of the site work.

3.1.5 Soil Erosion and Sedimentation Controls

Prior to the start of any excavation activities, soil erosion and sedimentation controls will be emplaced. A silt control fence will be erected along the downslope perimeter of the planned limits of excavation (Figure 7); the total length is approximately 550 feet. This silt fence will be constructed of Exxon GTF 101S or equivalent woven geotextile in accordance with the detail in Figure 8. Remcor will maintain the silt fence as needed for the duration of the project activities. The silt fence will be left in place following the cover construction.

3.1.6 Site Facilities

The proposed layout of site facilities is shown in Figure 7. This arrangement was established based on the following criteria:

- Operations safety, which includes efficient, organized, and predictable flow of workmen and equipment
- Minimizing the potential spread of contamination by production personnel and equipment
- Efficient and regular production cycling as excavation proceeds

- Minimizing the surface area of the potentially contaminated work site.

Project personnel will enter the work area through the personnel gate. They will be allowed to leave the site only after passing through the personnel decontamination facility. To accommodate the siting of this facility, an estimated 300 yd³ of fill materials will be excavated and temporarily stockpiled. Sorting and segregation of this material will be conducted as described in Section 3.2.2. Similarly, soils sampling at the limits of the excavation will be performed as described in Section 3.4. The excavation will be backfilled with soil provided by Armco or from off-site borrow sources.

3.1.6.1 Personnel Decontamination Facility

The personnel decontamination facility will include clean change rooms, lockers, and shower facilities for all personnel at the project site. Personnel working in contaminated areas will be required to remove their work clothes and shower before changing into street clothes at the end of their work shift. They will be required to remove work clothes and wash their hands prior to eating, drinking, or smoking in secure areas. No contaminated items will be worn or carried out of the project area. Disposable items (e.g., respirator cartridges, coveralls, inner gloves) that becomes contaminated will be included with the waste destined for off-site disposal.

Wash water from the personnel decontamination facility will be sent to the publicly owned treatment works (POTW) under the terms of an industrial discharge permit from the City. This water will be piped for discharge at a nearby sanitary sewer manhole. A total wash water volume of 1,000 gallons per week is estimated.

3.1.6.2 Equipment Decontamination Facility

The identified wastes at the North End former disposal area are buried, with an existing surface cover of clean soil and gravel. Within the

site work zone, access for off-site transportation vehicles will be limited to undisturbed areas or areas previously excavated and backfilled with clean soil. In addition, the truck loading procedure (Section 3.3) is designed to avoid contaminating these vehicles with the wastes being loaded. By use of these procedures, equipment decontamination requirements will be kept to a minimum throughout the excavation operations.

After waste removal and backfilling are completed in the area of the main truck gate to the North End area, a temporary equipment decontamination pad will be established in this vicinity (Figure 7). This pad will be constructed of a 6-inch thick mesh-reinforced concrete slab, 15 by 25 feet in plan, placed on a properly prepared subbase. The concrete surface will be coated with a water sealant. Timbers (e.g., railroad ties) will be securely anchored to the concrete along the sides of the pad, and the concrete surface will be sloped to the center to allow for collection of spent wash waters.

A steam cleaner or high-pressure washer will be used to clean surfaces of equipment that were in direct contact with the waste or otherwise may have become contaminated. Wash water generated in this cleaning will be collected by wet vacuums or small submersible pumps; this water will be collected in a tank and tested for the following:

- pH
- Solids (total dissolved, total suspended)
- Total lead
- Total zinc
- VOCs
- Total cyanides.

The FSAP (Appendix E) provides sampling and analysis protocols.

If this wastewater meets the criterion set forth in Armco's industrial wastewater discharge permit, this water may be discharged to a specified nearby sanitary sewer manhole. The total wash water volume is estimated to be less than 7,500 gallons. As an option to POTW discharge, this

water may be used for on-site dust control (Section 3.2.2.2) provided it meets the following quality criteria:

- pH - between 6.0 and 9.0
- Total lead - less than 0.05 mg/l
- Total zinc - less than 5.0 mg/l
- Total VOCs - less than 0.010 mg/l
- Total cyanides - less than 0.2 mg/l.

3.1.6.3 Utilities

Temporary electric and telephone service will be established, as needed, from existing services along Manchester Avenue. All waste removal work will be performed during daylight hours, and temporary lighting of the site will not be necessary.

Sanitary facilities will be provided either at the personnel decontamination facility, in which case sanitary wastewater would be discharged to the POTW (estimated flow of less than 500 gallons per week), or by portable toilets. A contract sanitation service would supply the portable toilets and handle wastewater.

3.2 EXCAVATION AND ON-SITE MATERIALS HANDLING

The RI has identified four general types of fill within the proposed work limits of excavation:

- Homogeneous black powdery to granular lead-containing dust
- Mixed lead-containing material and debris
- Mixed lead-containing material soil
- Other fill and construction debris.

The excavation and on-site materials handling procedures have been designed to remove each of these materials with simple, efficient handling and disposition (Figure 9). The crew size and types of equipment to be employed have been selected based on the production rates required for efficient operation, considering the limited working room and the rates at which transportation vehicles can be loaded. Work in the North End area will be staged and conducted to minimize interference with normal plant operations.

3.2.1 Excavation

Excavation of the waste area will be performed by a crew consisting of an operated backhoe and loader and technicians under the direction of a foreman. After the initial excavation required for siting of the personnel decontamination facility (Section 3.1.6), the excavation operation will begin at the northwest corner of the removal area and proceed to the south and east (Figure 7).

In each stage of excavation, materials will be excavated downward to the limits of visibly identifiable waste. Once an area is excavated to its anticipated final depth, the crew will relocate to the east and continue until all visibly identified wastes are removed. Figure 10 presents a schematic of the excavation operation.

3.2.2 Materials Handling

As indicated in Figure 10, the excavated materials will be segregated based on their visually identifiable composition. Figure 9 shows the flow chart for the handling and disposition procedures for the various categories of expected materials.

3.2.2.1 Visibly Clean Soil

It is anticipated that approximately 50 percent of the materials excavated (i.e., 6,000 yd³) will be comprised of visually clean soils. These soils consist of overburden and soils that lie between pockets of waste materials. The clean soils will be placed in lenticular stockpiles (i.e., windrows) along the side of the excavation away from the work crew (Figure 10). These soils will be tested on a frequency of one sample per 500 yd³ stockpiled, with the sample submitted to an off-site laboratory for total lead analysis. Analysis turnaround will be specified at 24 hours. The FSAP (Appendix E) provides sampling and analysis protocols. Any soils exhibiting a total lead concentration in excess of the applicable cleanup standard (Appendix H) will be resampled for EP toxicity lead analysis. The disposition of visibly clean soil will then proceed as follows:

- Total lead less than applicable cleanup level - Use as site backfill
- Total lead greater than applicable cleanup level - Dispose off site as hazardous waste if EP toxic or as nonhazardous waste if not EP toxic.

If off-site disposal is necessary, receiving facilities will be the same as those used for other wastes leaving the site (Section 3.2.2.2). Based on the results of the RI, it is expected that the majority of the visibly clean soil will exhibit total lead concentrations below the site-specific cleanup standards (Appendix H).

3.2.2.2 Mixed Black Dust, Soil, and Debris

Observations during test pitting at the North End former disposal area suggest that nearly half of the excavated material (estimated quantity of 5,500 yd³) will be comprised of mixed black dust, soil, and debris. As these heterogeneous materials are excavated, they will be placed atop a vibratory screen to allow segregation of materials by size categories:

- The coarse fraction (estimated quantity of 2,000 yd³) will consist of construction rubble, wire, and miscellaneous debris.
- The fine fraction (estimated quantity of 3,500 yd³) will be comprised of mixed soils and black dusts.

The segregated materials will be placed in temporary stockpiles to await removal for off-site disposition.

Dust control measures are potentially required during the handling of mixed lead-bearing dusts, soil, and debris. Fine water sprays will be applied to materials as they are loaded atop the screen. During extended periods of dry, windy weather, water will also be sprayed on the ground along access routes and excavation areas within the site. This water spraying will be performed using a truck-mounted tank and spray hoses. In no case, however, will the quantity of water applied be sufficient to generate free liquids associated with the waste.

The water used for dust control will be taken from one or more of the following sources (in order of preferences):

- Spent wash waters showing no acceptable levels of site contaminants (Section 3.1.6.2) and low total suspended solids
- Site ground water withdrawn from Wells MW-2, MW-3, and MW-3A (after on-site treatment by activated carbon adsorption with confirmation that the standards defined in Section 3.1.6.2 are met)
- Blue River
- Plant water supply.

Dust control measures will be implemented as necessary to avoid the off-site release of visible dust emissions. It is the responsibility of the Remcor on-site supervisor, or his designee, to ensure that such emissions are prevented. If, at any time, dust generation increases to the point where such releases appear imminent, dust-producing site operations will be suspended and dust control procedures enhanced. Such additional measures may include covering dust-producing areas (e.g., soil stockpiles) with polyethylene sheeting, rewatering of excavation areas, and/or increased water application rates at the screening operation.

Perimeter air monitoring will be conducted in the event of visible emissions to off-site areas. The need for such monitoring will be determined by the Remcor on-site supervisor based on his observations of site conditions. If it is needed, this perimeter monitoring would involve the collection and analysis of dust samples for total lead content at two downwind stations. Each station would consist of the following equipment:

- Low-volume sampling pump (1 to 4 liters per minute air flow rate) mounted on a post approximately 3 to 6 feet above the ground surface

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- Cellulose ester filter with 0.8-micron pore size, 37 millimeters in diameter, in a cassette filter holder, connected to the sampling pump inlet by flexible (e.g., Tygon®) tubing.

Air samples would be collected over an 8-hour period beginning immediately after the observed off-site release and during the entire work shift the following day.

All collected samples would be analyzed using atomic absorption spectrophotometry in accordance with U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health Method 7082. If the lead dust concentration at the site perimeter is found to exceed 50 percent of the U.S. Department of Labor, Occupational Safety and Health Administration action level for any day of operations, the work activities associated with the dust emissions will be suspended until reviewed with Armco and the EPA to develop methods that avoid or minimize off-site airborne emissions.

Throughout the screening operation, fine water sprays, or equivalent control measures, will be used on an as-needed basis to retard dust generation. The water sprays rate will be limited to ensure that, at no time, free liquids become associated with the waste. The need for dust control will be continuously assessed in the field based on the criterion that no visible air emissions from the site are acceptable.

The coarse-fraction materials are considered unsuitable for use as on-site backfill and will be removed for off-site disposition. If practicable, wire and steel scrap will be separated by hand and returned to the Armco Kansas City Works as scrap for reuse in steelmaking. Otherwise, all such rubble and debris will be loaded into transportation

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vehicles and disposed off site as industrial waste. Disposal will occur at the Waste Management, Inc. (WMI) Forest View Landfill in Kansas City, Kansas or equivalent approved facility. The Forest View Landfill is permitted to receive nonhazardous debris of this type.

The mixed soil and dust that pass through the vibratory screen will be placed in windrows (Figure 10). Representative samples will be collected at a frequency of one sample per 200 yd³ stockpiled and analyzed for EP toxicity. Laboratory analysis turnaround of 48 hours will be specified. The FASP (Appendix E) provides sampling and analysis protocols. Based on the results of this testing, these materials will be disposed as follows:

- EP toxic materials (estimated quantity of 1,000 yd³) will be disposed of as hazardous waste at the USPCI Landfill in Lone Mountain, Oklahoma or equivalent permitted facility.
- Materials that are not EP toxic (estimated quantity of 2,500 yd³) will be disposed of at the WMI Forest View Landfill or equivalent permitted facility.

3.2.2.3 Homogeneous Black Dust

Discrete horizons or pockets of homogeneous black dust are expected to be encountered, based on the findings during test pit excavation at the North End former disposal area. A total volume of 500 yd³ of this material has been estimated.

Pockets of the black dust material will be excavated, and the removed wastes will be placed directly into prepared roll-off containers (Figure 10). Delivery of these wastes at the USPCI Landfill in Lone Mountain, Oklahoma (or equivalent permitted facility) is considered the likely disposition, as the quality and consistency of these materials cannot be

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adequately ensured to receive a firm commitment for acceptability at a secondary lead smelter. If, during the course of excavation, large pockets of such material are found, additional discussions with candidate recyclers will be conducted to attempt recovery of these materials.

3.2.3 Surface Water Control

During excavation, a temporary berm will be constructed using visibly clean soil at the top of slope as needed to route surface runoff around the excavation area. Material handling for the adjacent work areas will be accomplished in a manner to minimize ponding of surface water. Rainfall accumulation within the excavation is not anticipated to be significant during the project schedule period and is expected to infiltrate the subgrade or evaporate. Remcor does not plan to perform excavation dewatering or to treat surface water runoff.

3.3 MATERIALS LOADOUT

Except for the homogeneous black dust materials that will be loaded directly by the backhoe into prepared roll-off boxes, waste materials destined for off-site disposal will be placed in the transportation vehicles by the front-end loader. Special precautions will be taken during loading to avoid the potential for spreading contamination. All loading operations will be conducted within the limits of the work area, and no transportation vehicle will be allowed to leave this area until it has been thoroughly inspected. Any vehicle showing signs of external contamination will be routed to the equipment decontamination facility or manually cleaned in place, if necessary. Loading operations will not be performed during periods of very high winds or immediately after periods of extended excess rainfall. Aspects of the loading operations

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specific to the various waste categories are addressed in the following paragraphs. All transportation vehicles (i.e., dump trucks, trailers), including those hauling nonhazardous waste or debris, will be covered with heavy canvass tarpaulins prior to leaving the site.

3.3.1 Construction Rubble and Debris

Construction debris and rubble will be loaded into 20-yd³ (nominal) dump trailers. These trailers will not be lined because such liners would most likely be torn in the loading process. The tailgates of all such trucks will be inspected to ensure that they close tightly, and all loads will be covered with canvass tarpaulins. These loads will be accompanied by bills of lading describing their contents.

3.3.2 Mixed Contaminated Soils and Dusts

Mixtures of contaminated soils and dusts will be loaded into properly prepared 20-yd³ dump trailers. Whether or not the material is a characteristic hazardous waste, these dump trailers will be lined with six-mil polyethylene sheeting that will be secured to the side boards of the trailer and draped to the ground on the loading side. Once loaded, the sheeting will be folded atop the load and then the trailer will be covered with a heavy canvass tarpaulin. All trailers carrying these wastes will have sealed tailgates.

Hazardous waste shipments will be accompanied by properly completed uniform waste manifest forms identifying Armco as the generator. Shipments of nonhazardous wastes will be accompanied by bills of lading.

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3.3.3 Homogenous Black Dusts

The roll-off boxes used to contain the homogenous black dusts will similarly be lined with six-mil polyethylene sheeting and will be covered with tarpaulins. These shipments will be accompanied by properly completed hazardous waste manifests.

3.4 CONFIRMATORY TESTING

Upon completion of waste excavation within each stage (Section 3.2.1), soil sampling will be conducted at the limits of the excavation. Soil samples will be collected at relatively equally spaced locations at a frequency of one sample per 2,000 ft² of removal area. This frequency is designed to correspond to sampling at 50-foot intervals (north-south) within each 40-foot wide excavation stage. Samples will be collected using a bucket-type hand auger or similar coring device from the 0- to 6-inch and 6- to 12-inch vertical increments below the bottom of the excavation. Similar excavation sidewall (outer perimeter) samples will be collected at mid-height at a 50-foot horizontal spacing. The uppermost sample at each location will be analyzed for total lead with 24-hour laboratory analysis turnaround. The FSAP (Appendix E) provides sampling and analysis protocols.

The limits of excavation will also be systematically surveyed with an OVA to detect the presence of any localized presence of VOCs in residual soils. OVA readings will be taken at each soil sampling location by placing an approximate 50 grams of sample in a 1,000-ml glass sample bottle. After sealing the bottle and allowing it to sit undisturbed for a minimum of 10 minutes, the OVA will be used to take a headspace measurement in the bottle (Appendix E). If positive OVA readings are identified at any location, the soil sample from that location will be analyzed for VOCs.

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If the total lead concentrations in the soil at each excavation stage (Figure 7) meet the applicable cleanup standard as described in Appendix H, the excavation will be deemed complete in this area, and backfilling will commence. If the applicable cleanup standard is not met, one or more of the lower samples from within that excavation stage will be analyzed and additional soil removal will be performed in an incremental fashion as needed to meet the target level.

The decision to remove any soils based on VOC concentrations will be made by Armco based on the estimated quantity of such soils, actual VOC concentrations, and evaluations of the likelihood of such soils contributing to VOC concentrations in ground water. Any such removal of VOC-contaminated soils would be performed as an extension of the work defined in the Consent Agreement.

3.5 SITE RESTORATION

Concurrent with the excavation, sorting, and testing activities, clean soil will be backfilled in completed areas. To the south of the rechannelization line, the excavation will be backfilled with acceptable fill material that had been previously removed from the excavation. The material will be placed to achieve the following:

- A continuous slope gradually draining toward the Blue River
- Continuous terrain in the area of the acid rinsewater tank and hydrochloric acid storage tank
- Continuous gradual slope up to the existing roadway north of Building 30.

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Only minimal regrading will be conducted to prepare the area within the COE work limits. After grading operations are completed, all disturbed areas will be seeded with a mixture of rapid-emergent and erosion-resistant grasses. Seeded areas will be mulched to minimize short-term soil erosion.

3.6 DEMOBILIZATION

Remcor will demobilize personnel, equipment, and materials following site restoration. At this time, incidental activities associated with the work plan will be performed, such as removal of the temporary barricade, repair of the existing asphalt road, and placement of the chain-link fence. The silt fence will remain in place during establishment of the vegetative cover and will be assumed the responsibility of the COE thereafter.

The temporary equipment wash pad will be steam cleaned and left in place. The generated wash water will be disposed of in accordance with Section 3.1.6.2.

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4.0 GROUND WATER INVESTIGATION

4.1 BACKGROUND

As described in Section 2.2.1.3, 10 wells have been installed at the UWR plant site and monitoring of ground water quality has been conducted on a quarterly basis beginning in January 1988. This chapter describes the additional ground water investigation that will be conducted in accordance with the COA. These studies are designed to identify potential sources and determine the ultimate fate of VOC and lead contamination of the ground water in the North End former disposal area.

4.2 SCOPE OF ACTIVITIES

The ground water investigation at the North End former disposal area is an extension of the previously conducted RI. These additional studies involve the following:

- Installing two deeper wells as companions to existing shallow Wells MW-1 and MW-3
- Installing three shallow wells downgradient of the North End former disposal area
- Conducting two rounds of ground water sampling and analysis for the 5 newly installed and 10 previously installed wells
- Preparing a report of investigation for submittal to the EPA and Missouri DNR that includes the results of the studies and recommendations for future actions, if necessary.

In addition, any site wells damaged or destroyed in waste removal activities will be replaced.

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The following sections describe the work to be undertaken to complete these tasks.

4.3 WORK PLAN

4.3.1 Well Installation

Ground water monitoring wells will be installed at the approximate locations identified in Figure 11; all wells will be drilled upon completion of waste removal activities. The deep wells will be drilled to the top of bedrock at a depth of approximately 60 feet and screened in the lower portion of the aquifer. These wells will be designated as Wells MW-1D and MW-3B in reference to their existing companion wells. The shallow wells will be drilled to similar depths as existing Wells MW-1, MW-2, and MW-3 (approximately 20 to 25 feet), depending on the final grading of the area and identification of the ground water elevation. These wells will be designated as Wells MW-10, MW-11, and MW-12.

The wells will be drilled using a truck-mounted geotechnical rotary drill. The drilling of each of the wells is expected to be by means of hollow-stem augers to provide for the collection of split-spoon soil samples.

Because the alluvial deposits along the Blue River likely coarsen with depth, hollow-stem auger drilling to an expected depth of about 60 feet may not be possible. Typical truck-mounted rotary drill rigs cannot effectively turn hollow-stem augers through boulder-size materials at depths greater than about 25 feet. In the event that the hollow-stem auger method is ineffective for the deep wells, these holes may be advanced using cable tool methods. Mud rotary drilling will be used only if other available techniques prove unsuccessful.

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To provide soil samples for characterizing the subsurface lithology, split-spoon soil samples will be collected on five-foot vertical centers, or more frequently as required to log the boring. Collection of split-spoon samples will be in accordance with ASTM Method D 1586-74. The decontaminated 2-inch diameter split-spoon sampler will be advanced 18 or 24 inches by a 140-pound weight falling freely through 30 inches. Standard penetration resistance will be recorded and included on the boring logs.

Soil samples will be visually logged by an experienced, on-site Remcor geologist in accordance with the USCS. During the logging of the borings, particular attention will be paid to the presence of water in the sample.

The monitoring wells will be constructed of 2-inch inside diameter (ID) PVC 0.010-inch machine slotted screen and riser pipe. Upon completion of the drilling, the individually packaged or decontaminated well screen and riser will be placed into the boring, and sand will be packed to a distance of at least 2 feet above the screened portion of the PVC. A bentonite seal will be placed on top of the sand pack, and a bentonite grout will be tremied into the annulus of the well to ground surface. Emplacement of the bentonite seal and bentonite grout will serve to reduce the risk of cross contamination that could result if vertical migration is possible in the borehole. A locking steel protective cover will be placed over the well to provide a measure of security.

After the wells have been completed, each will be developed by either bailing or airlift methods. The wells will each be developed for a minimum of 1.5 hours, or until fine-grained materials have been successfully removed. If it becomes necessary to use mud rotary drilling, extraordinary efforts will be employed in well development. Wells will be

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purged and pumped for a minimum of two hours, with frequent monitoring of pH, specific conductance, and turbidity. Such wells will be accepted as fully developed only after all three monitored parameters have stabilized. Sampling of wells for water quality analyses will not occur less than seven days after completion of well development.

Prior to any use of downhole equipment (e.g., split-spoons, auger flights, bailers, etc.), a thorough decontamination of the equipment will be made. Equipment and drill rig will be decontaminated by use of a steam cleaner prior to rig-up at each well. Any equipment requiring decontamination during drilling will be cleaned in accordance with the FSAP.

4.3.2 Sampling of Additional Monitoring Wells

The newly installed Monitoring Wells MW-1D, MW-3D, MW-10, MW-11, and MW-12 will be sampled in conjunction with fourth quarter 1989 and the first quarter 1990 ground water sampling at the UWR site. Water levels will be measured in all wells. The collected ground water samples from all wells will be analyzed for the following suite of parameters:

- pH, specific conductance, and alkalinity
- Lead (total and dissolved)
- Nitrates
- Phenolics
- Priority pollutant VOCs
- Polychlorinated biphenyls (PCBs).

In addition to the standard QA samples (one replicate and one bailer blank), an additional replicate will be collected from one of the new wells. This replicate sample will be analyzed for VOCs only. Methods for sample handling, documentation, and sampling equipment decontamination are described in the FSAP (Appendix E).

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4.4 REPORT DOCUMENTATION

Following the two quarterly ground water sampling rounds at the UWR site, the results of the laboratory analysis, the subsurface investigation, and recommendations regarding the technique for ground water remediation, if required, will be prepared in report fashion and presented to the EPA, and the Missouri DNR.

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5.0 SCHEDULE

Figure 12 presents the proposed schedule for the removal action at the North End former disposal area. This schedule, which includes both waste excavation activities and additional ground water studies, is based on performing the removal work during the 1990 construction season.

As shown in Figure 12, the overall work effort will be completed in 11 months. The waste removal requires five months; the additional ground water studies will be conducted over a six-month time frame.

The schedule provides four weeks to mobilize personnel, equipment, and materials; perform a site survey; erect erosion controls; and install site facilities. The excavation, material handling, and disposal activities are anticipated to be accomplished in 15 weeks. Site grading and restoration, revegetation, and demobilization activities are scheduled for three weeks.

The additional ground water investigations will be initiated upon completion of the removal action. Sampling and analysis will be performed over two calendar quarters. Reporting can be accomplished within four weeks of receipt of final (second quarter) laboratory analysis data.

TABLES

TABLE 1

ANALYTICAL METHOD REFERENCES AND DETECTION LIMITS

MEDIUM/PARAMETER	DIGESTION/ EXTRACTION	REFERENCE (1)	ANALYSIS	REFERENCE (1)	LABORATORY DETECTION LIMIT	UNITS
<u>Soils/Bulk Materials:</u>						
• PP VOCs (2)	3550/5030	1	8240	1	5 to 250	µg/g
• EP Toxicity:						
- Arsenic	1310	1	7061	1	0.1	mg/l
- Barium	1310	1	7080	1	10	mg/l
- Cadmium	1310	1	7130	1	0.1	mg/l
- Chromium	1310	1	7190	1	0.1	mg/l
- Lead	1310	1	7420	1	0.1	mg/l
- Mercury	1310	1	7471	1	0.01	mg/l
- Selenium	1310	1	7741	1	0.1	mg/l
- Silver	1310	1	7760	1	0.1	mg/l
• Total Cyanides	-	-	9010	1	1	µg/g
• Total Lead	3050	1	7420	1	10	µg/g
• Total Zinc	3050	1	7950	1	10	µg/g
• Oil and Grease	9071	1	9071	1	50	µg/g
• 1:1 pH	-	-	9045	1	+/-0.01	pH unit (su)
• Lime Requirement	-	-	3.2.10	2	0.3	lbs CaCO ₃ / 1,000 lbs
<u>Ground Water:</u>						
• Alkalinity	-	-	310.2	3	1	mg/l CaCO ₃
• pH	-	-	9040	1	+/-0.01	pH unit (su)
• Specific Conductance	-	-	9050	1	1	µmhos/cm
• Nitrates	-	-	342.1	3	0.1	mg/l NO ₃ -N
• PP VOCs (2)	5030	1	8240	1	5 to 250	µg/l
• PP Acid Extractable Organics	3510	1	8270	1	10 to 50	µg/l

See footnotes at end of table.

TABLE 1
(Continued)

MEDIUM/PARAMETER	DIGESTION/ EXTRACTION	REFERENCE ⁽¹⁾	ANALYSIS	REFERENCE ⁽¹⁾	LABORATORY DETECTION LIMIT	UNITS
• Metals (total):						
- Arsenic	-	-	7061	1	0.001	mg/l
- Barium	-	-	208.2	3	0.01	mg/l
- Beryllium	-	-	7090	1	0.01	mg/l
- Cadmium	-	-	7130	1	0.01	mg/l
- Chromium	-	-	7190	1	0.01	mg/l
- Copper	-	-	7210	1	0.01	mg/l
- Lead (3)	-	-	7421	1	0.001	mg/l
- Mercury	-	-	7470	1	0.005	mg/l
- Nickel	-	-	7520	1	0.1	mg/l
- Selenium	-	-	7741	1	0.001	mg/l
- Silver	-	-	7760	1	0.01	mg/l
- Zinc	-	-	7950	1	0.01	mg/l
• Oil and Grease	-	1	9070	1	1	mg/l
• Phenolics	-	-	8040	1	0.01	mg/l

(1) References:

- 1 - U.S. Environmental Protection Agency (1986)
- 2 - Sobek, et al. (1978)
- 3 - U.S. Environmental Protection Agency (1983).

(2) "pp VOCs" refers to priority pollutant volatile organic compounds.

(3) Dissolved lead analyses were performed on field filtered (0.45-micron) samples collected in September 1989.

TABLE 2
RESULTS OF LABORATORY ANALYSES
SOIL AND FILL MATERIALS

TEST PIT NO. (1)	SAMPLE NO.	DEPTH INTERVAL (feet)	SAMPLE DESCRIPTION (2)	TOTAL METALS			EP TOXICITY LEACHATE (3)		TOTAL CYANIDES (µg/g)	OIL AND GREASE (µg/g)
				LEAD (µg/g)	ZINC (µg/g)		LEAD (mg/l)			
TP-1	01C-1	1.0	Black dust/soil mixture	4,400/6,700 ⁽⁴⁾	1,200/1,400		1.6		<1 ⁽⁵⁾	900
TP-2A	02A-1A	8.5	Brown silty clay	280/340	450		<0.1		<1	<50/80
	02A-1 ⁽⁶⁾	2.5	Black dust	20,000/15,000	4,300		5.5/6.1		<1	<50
TP-3B	03B-1	0.5 to 1.0	Black dust	26,000/23,000	1,100		10/14		<1	1,600
TP-4A	04A-1A ⁽⁶⁾	4.0	Black sludge	3,800	520		1.5		<1	<50
TP-4B	04B-1	0.3 to 7.5	Black powder	130,000/100,000	340		1.5/1.7		<1	1,100
TP-5A	05A-1	5.0	Black dust	430	1,500		1.2		<1	340
TP-6A	06A-1A	1.0	Black dust and scale	710	250		0.1		<1	400
	06A-1B	6.0	Brown silty clay	52	53		<0.1		<1	120
TP-7A	07A-1A//1B	2.0	Black dust and scale	210//100 ⁽⁷⁾	190/180//57/57		0.2//0.1		<1//<1	740/350//<50/<50
TP-8	07A-1C	8.0	Miscellaneous fill	590	250		0.1		<1	1,000
	07A-1D	10.0	Gray silty clay	23	84		<0.1		<1	160
	08A-1A	1.5	White sandy material	52	73		<0.1		13/10	52
	08A-1C	6.0	Black dust	3,400	3,400		0.2		<1	2,300/4,900
	08A-1D	1.0	Black/red sandy material	4,700	2,000		0.6		<1	350
	08A-1E ⁽⁶⁾	1.0	Black/red sandy material	NA	NA		<0.1		<1	NA
	08A-1F	1.0	Black dust and soil	480	2,100		<0.1		<1	1,900

(1) For plan locations of test pits, see Figure 3.

(2) Test pit logs are provided as Appendix A.

(3) EP toxicity leachates were analyzed for all eight metals identified in 40 CFR 261.24; remaining metals were not detected above minimum detection limits.

(4) "##" indicates results of duplicate laboratory analyses, including reanalysis of certain samples.

(5) "<" indicates below minimum detection limit given.

(6) Split of sample was analyzed for priority volatile organic compounds; none were detected above minimum detection limits.

(7) "##//#" indicates results of replicate analyses of replicate field samples.

TABLE 3
RESULTS OF LABORATORY ANALYSES
SOILS IN HCl STORAGE AND ACID RINSEWATER EQUALIZATION TANK AREAS

AREA	TEST BORING NO.	SAMPLE NO.	DEPTH INTERVAL (feet)	1:1 pH (su)	LIME REQUIREMENT ⁽²⁾ (lbs CaCO ₃ /1,000 lbs)
Hydrochloric Acid Storage	TB-7	007-1A	1.5 to 2.0	8.30	N/A ⁽³⁾
		007-1C	4.5 to 5.0	7.50	N/A
	TB-8	008-1A	1.0 to 1.5	11.80 ⁽⁴⁾	N/A
		008-1C	4.5 to 5.0	8.90 ⁽⁴⁾	N/A
Acid Rinsewater Equalization Tank	TB-9	009-1G	11.0 to 11.5	8.50	N/A
		009-1I	14.5 to 15.0	7.90	N/A
		009-1J	16.5 to 17.0	5.90	1.0
	TB-10	010-1H	11.5 to 12.0	8.20	N/A
		010-1J	14.5 to 15.0	8.00	N/A
		010-1K	16.5 to 17.0	6.80	<0.3 ⁽⁵⁾
	TB-11	011-1F	11.0 to 11.5	8.20 ⁽⁴⁾	N/A
		011-1H	14.5 to 15.0	6.20	0.3
		011-1I	16.5 to 17.0	6.50	<0.3

(1) For test boring locations, see Figure 3.

(2) Lime requirement - number of pounds of calcium carbonate per 1,000 pounds of material required to bring pH to 6.5.

(3) "N/A" indicates not applicable.

(4) Verified by duplicate analyses.

(5) "<" indicates below stated detection limit.

TABLE 4
SUMMARY OF GROUND WATER ANALYSIS DATA
JANUARY 1988 THROUGH SEPTEMBER 1989 (1)

PARAMETER	UNITS	NORTH END WELLS (2)				OPERATIONS AREA WELLS (2,3) (MW-4 through MW-7 and MW-9)	BACKGROUND WELL (2) (MW-8)
		MW-1	MW-2	MW-3	MW-3A		
<u>General Chemistry:</u>							
pH		6.15 to 7.20	6.00 to 7.25	6.50 to 7.70	6.35 to 7.70	5.95 to 7.80	6.65 to 7.70
Alkalinity	as CaCO_3	270 to 390	200 to 490	240 to 270	120 to 180	56 to 450	260 to 410
Specific conductance	microhm/cm	1,500 to 1,900	1,500 to 5,000	800 to 900	700 to 850	500 to 4,600	580 to 1,000
<u>Total Metals:</u>							
Copper (4)	mg/l	0.09	0.10	0.04	NA (5)	0.04 to 0.10	0.02
Lead	mg/l	<0.001(6) to 0.19	<0.001 to 0.035	<0.002 to 0.020	<0.001 to 0.009	<0.001 to 0.47 (7)	<0.001 to 0.008
Zinc (4)	mg/l	0.26	0.17	0.07	NA	0.09 to 11	0.03
<u>Volatile Organics:</u>							
Chloroethane	ug/l	<5 to 770	<5	<5	<5	<5	<5
1,1-dichloroethane	ug/l	<5 to 630	<5	<5 to 140	7 to 15	<5 to 170	<5
1,1-dichloroethylene	ug/l	18 to 200	<5	<5 to 3,400 (7)	26 to 290	<5 to 64	<5
Trans-1,2-dichloroethylene	ug/l	<5 to 250	<5	<5 to 67	<5	<5	<5
1,1,1-trichloroethane	ug/l	74 to 820	<5	64 to 430	41 to 97	<5 to 58	<5
Tetrachloroethylene	ug/l	<5	<5	<5 to 21	<5 to 30	<5	<5
Trichloroethylene	ug/l	<5 to 9	<5	<5 to 11	<5	<5 to 23	<5
Vinyl chloride	ug/l	<5 to 530	<5	<5 to 100	<5	<5	<5
Total VOCs		740 to 1,664	<5	218 to 4,081	116 to 361	<5 to 252	<5

(1) Reported values are ranges of all available data from multiple sampling rounds. For full reporting of ground water monitoring data, see Appendix D.

(2) For well locations, see Figure 2.

(3) Values are ranges from all five wells in the operations area.

(4) Analysis of compound discontinued after initial sampling round.

(5) "NA" indicates no data available.

(6) "<" indicates less than method detection limit.

(7) "NA" indicates not confirmed in subsequent analyses.

FIGURES



FIGURE 1

SITE LOCATION MAP

2000 0 2000 4000
scale feet

REFERENCE:

U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP,
7.5 MINUTE SERIES, KANSAS CITY, MO-KS
AND INDEPENDENCE, MO QUADRANGLES, 1974 PR.
SCALE 1:24000



PREPARED FOR
ARMCO INC.
MIDDLETOWN, OHIO

DRAWN	LBL 11/3/89	DRAWING NUMBER
CHECKED	MB 11/5/89	89119-A5
APPROVED	MB 11/5/89	

REMCOR

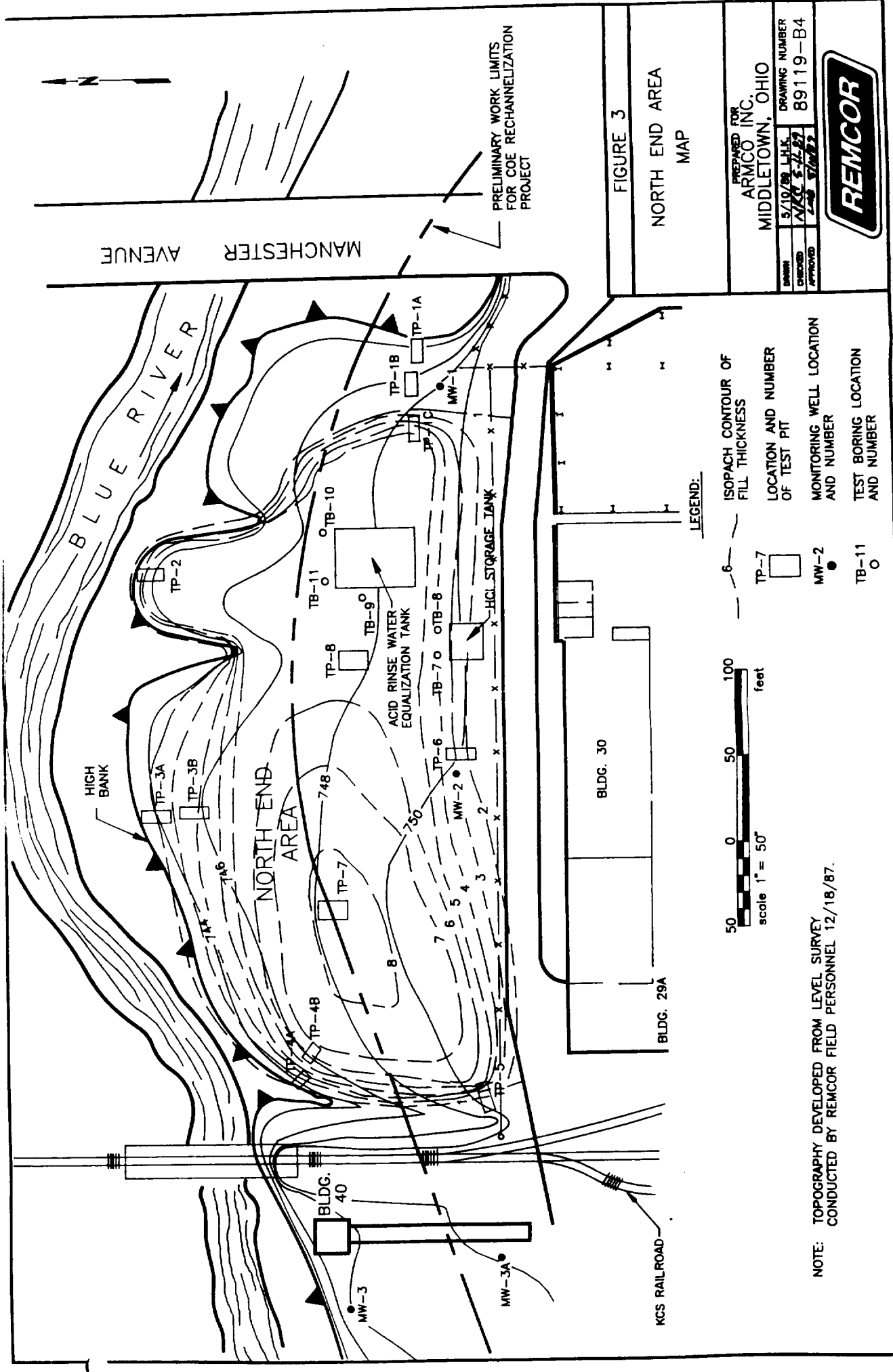


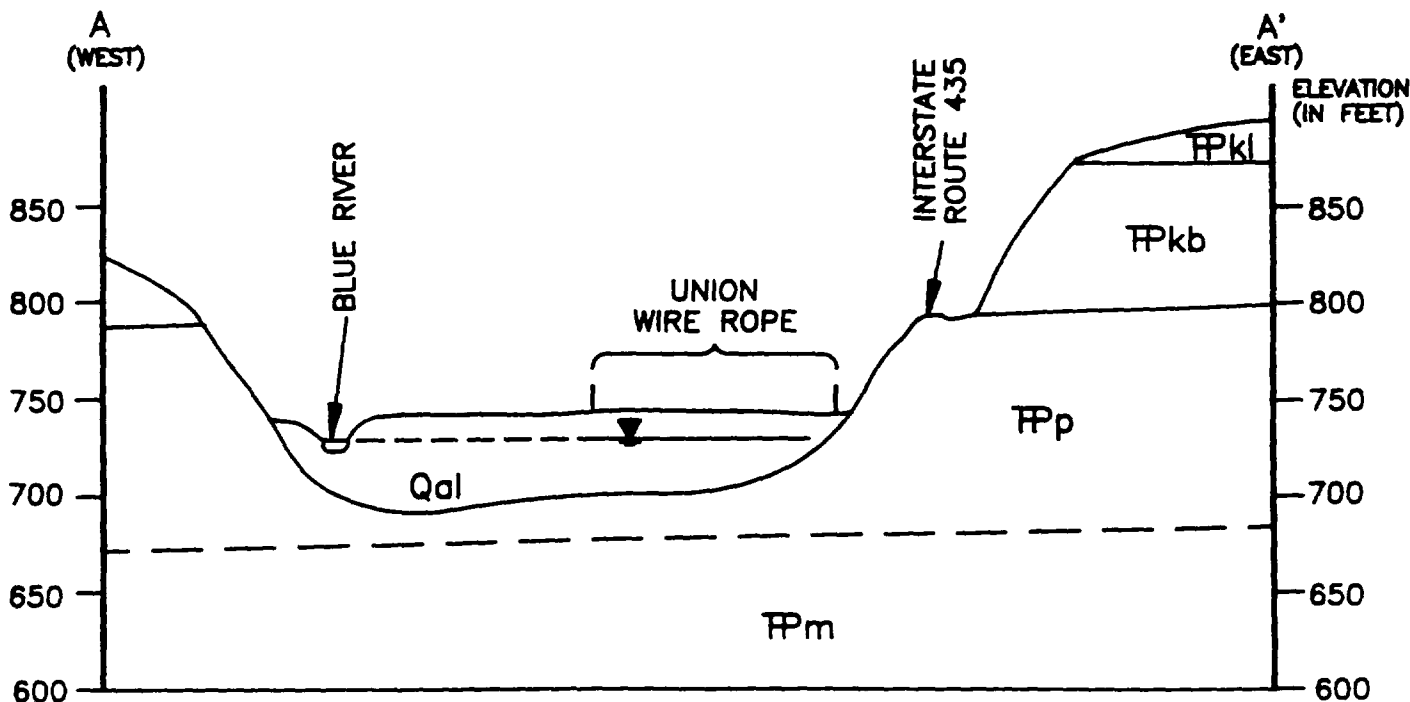
FIGURE 3

NORTH END AREA
MAP

PREPARED FOR ARMCO INC. MIDDLETOWN, OHIO			
DRAWN	5/10/88 L.H.K.	DRAWING NUMBER	89119-B4
CHECKED	5/10/88 L.H.K.	DATE	5/10/88
APPROVED	5/10/88 L.H.K.	DATE	5/10/88



NOTE: TOPOGRAPHY DEVELOPED FROM LEVEL SURVEY
CONDUCTED BY REMCOM FIELD PERSONNEL 12/18/87.



SECTION A - A'

QUATERNARY SYSTEM

Qal - BLUE RIVER ALLUVIUM - ALLUVIAL SAND, SILT AND GRAVEL

PENNSYLVANIA SYSTEM MISSOURIAN SERIES

TPkl - KANSAS CITY GROUP LINN SUBGROUP - PREDOMINANTLY SHALES WITH A FEW PERSISTENT LIMESTONES AND SOME THIN SANDSTONES

TPkb - KANSAS CITY GROUP BRONSON SUBGROUP - CYCLIC SEQUENCE OF THREE LIMESTONE FORMATIONS AND TWO SHALE-CLAY UNITS

TPp - PLEASANTON GROUP - ARGILLACEOUS TO SANDY, MICACEOUS SHALE AND FOSSILIFEROUS SILTSTONE

TPm - MARMATON GROUP - SHALE, LIMESTONE, SANDSTONE

SCALE:

HORIZ. 1" = 2000'

VERT. 1" = 100'

(VERTICAL EXAGGERATION 20X)

NOTES:

1. REFER TO FIGURE 1 FOR CROSS SECTION LOCATION.
2. GROUNDWATER ELEVATIONS ESTABLISHED AT WELLS MW-8 (EAST) AND MW-8 (WEST).
3. GROUNDWATER ELEVATIONS ARE NOT AVAILABLE IN BEDROCK UNITS.

REFERENCE:

PARIZEK (1968)

FIGURE 4

GENERALIZED CROSS SECTION AT THE UNION WIRE ROPE PLANT SITE

PREPARED FOR
ARMCO INC.
MIDDLETOWN, OHIO

DRAWN	7/13/89 L.B.L.	DRAWING NUMBER
CHECKED	1MB 4/9/89	89119-A3
APPROVED	1MB 4/9/89	

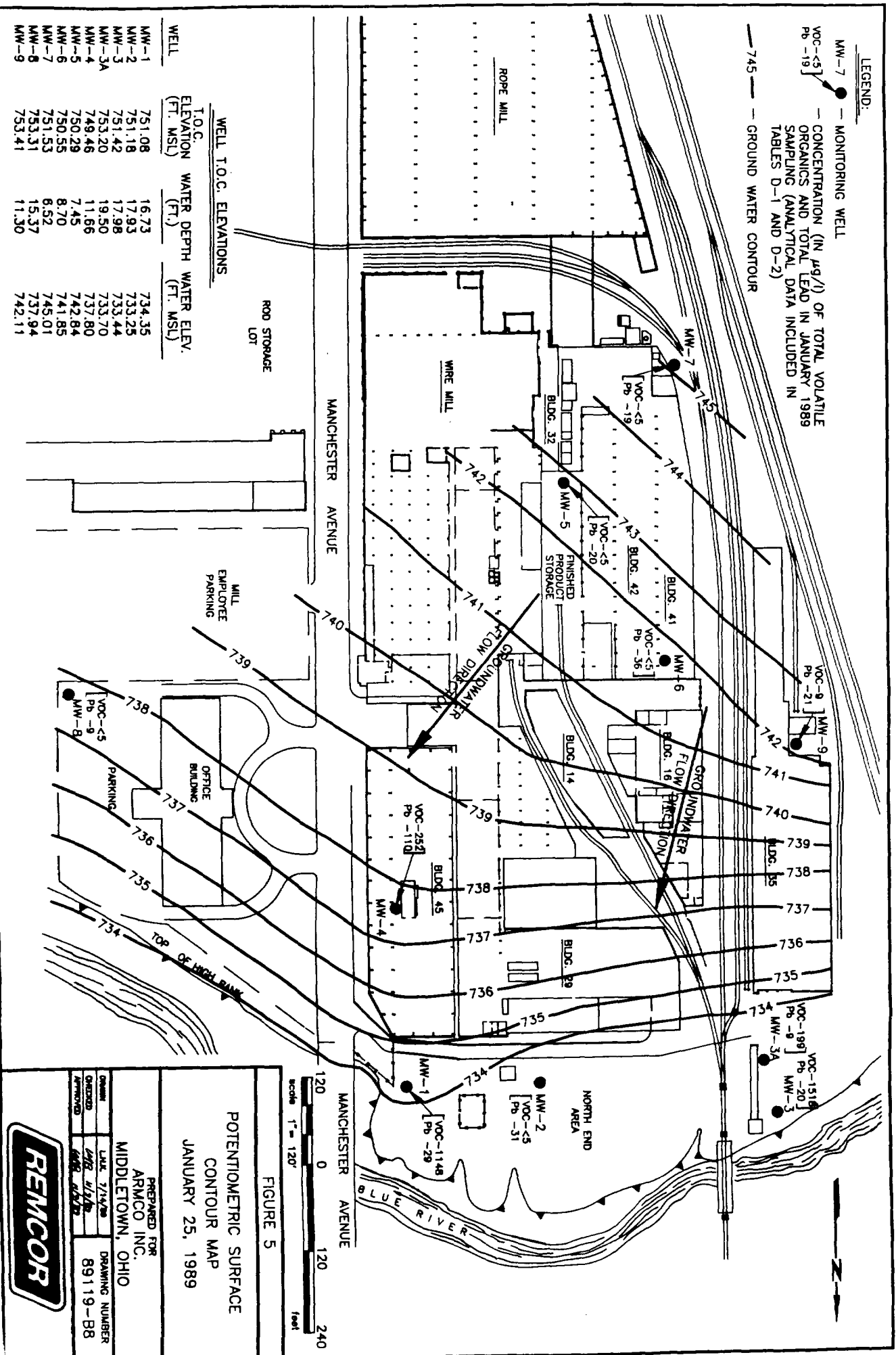


LEGEND:

MW-7 ● — MONITORING WELL

— CONCENTRATION (IN $\mu\text{g/l}$) OF TOTAL VOLATILE ORGANICS AND TOTAL LEAD IN JANUARY 1989 SAMPLING (ANALYTICAL DATA INCLUDED IN TABLES D-1 AND D-2)

— 745 — GROUND WATER CONTOUR



WELL T.O.C. ELEVATIONS

WELL	T.O.C. ELEVATION (FT. MSL)	WATER DEPTH (FT.)	WATER ELEV. (FT. MSL)
MW-1	751.08	16.73	734.35
MW-2	751.18	17.93	733.25
MW-3	751.42	17.98	733.44
MW-3A	753.20	19.50	733.70
MW-4	749.46	11.66	737.80
MW-5	750.29	7.45	742.84
MW-6	750.35	8.70	741.85
MW-7	751.53	6.52	745.01
MW-8	753.31	15.37	737.94
MW-9	753.41	11.30	742.11

FIGURE 5

POTENTIOMETRIC SURFACE CONTOUR MAP

JANUARY 25, 1989

scale 1" = 120'

feet

PREPARED FOR

ARMCO INC.

MIDDLETOWN, OHIO

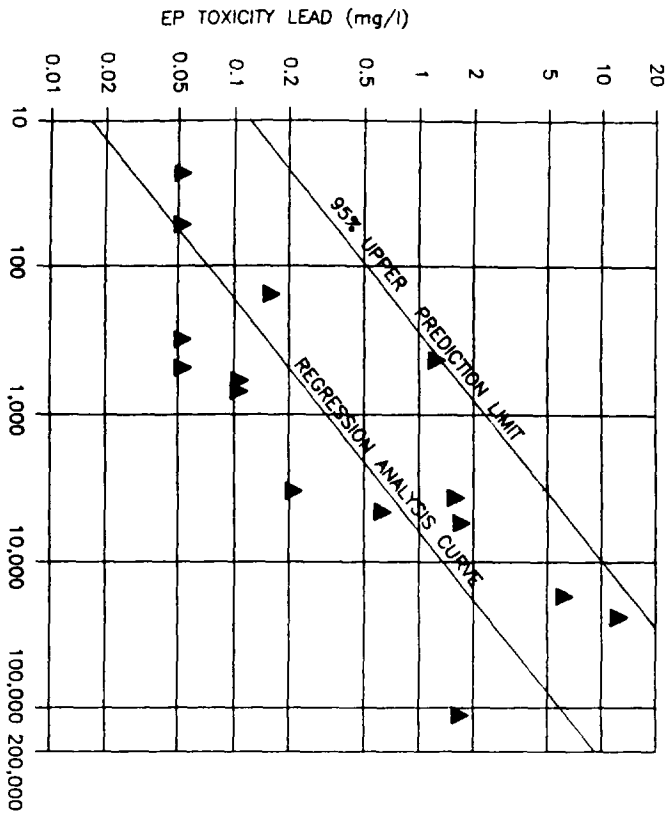
DATE 7/14/89

CHECKED BY JLB

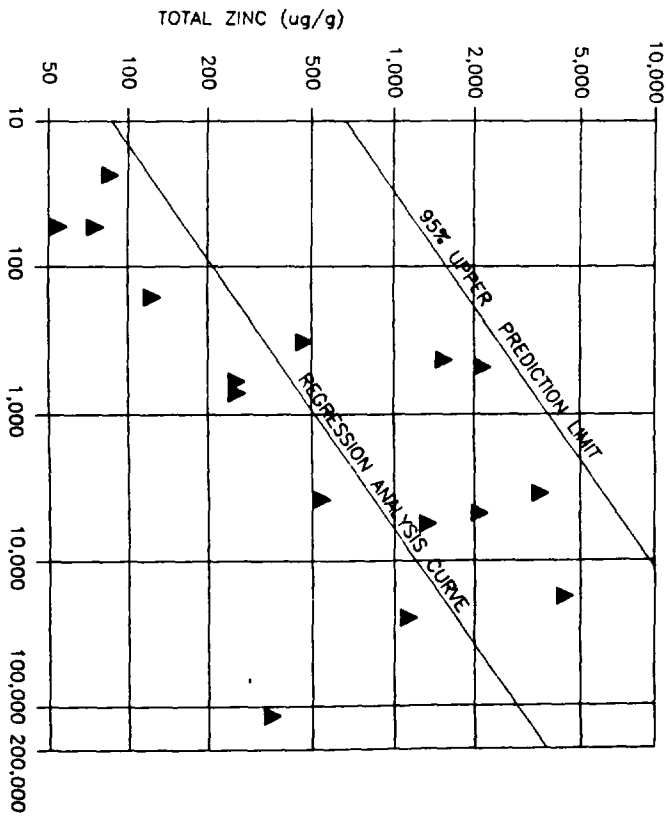
APPROVED BY JLB

DRAWING NUMBER 89119-B8





EP TOXICITY VERSUS TOTAL LEAD CONCENTRATIONS



TOTAL ZINC VERSUS TOTAL LEAD CONCENTRATIONS

FIGURE 6

DATA RELATIONSHIPS, METAL
LEVELS IN MATERIALS AT
THE NORTH END AREA

PREPARED FOR
ARMCO INC.
MIDDLETOWN, OHIO

DESIGNED	5/11/89 L.H.K.	DRAWING NUMBER
CHECKED	N.K.C. 5/11/89	89119-86
APPROVED	L.H.B. 5/11/89	

REV. GENERAL REVISION:
11/5/89 L.H.K.

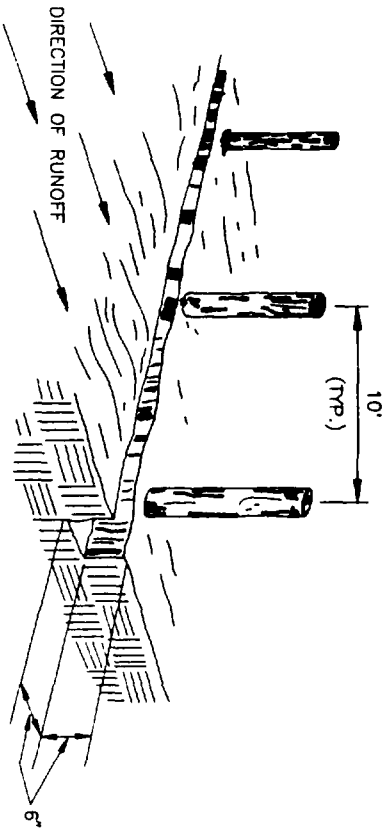


W.B. 11/9/89

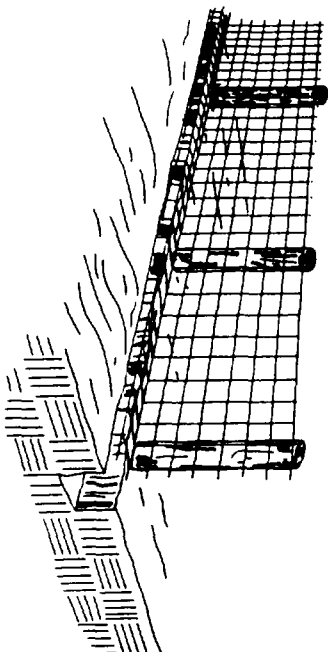


REV. 1

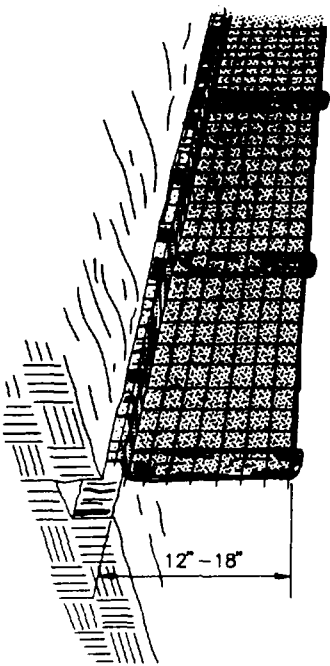
1. SET WOODEN OR METAL POSTS AND EXCAVATE A 6" X 6" TRENCH UPSLOPE ALONG THE LINE OF POSTS.



2. STAPLE WIRE FENCING TO THE POSTS



3. ATTACH SILT FILTER FABRIC TO THE WIRE FENCE AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.

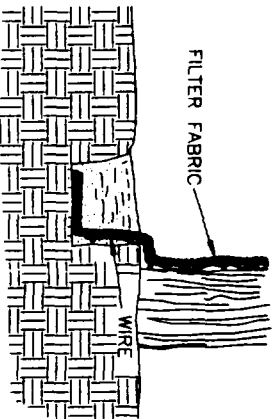
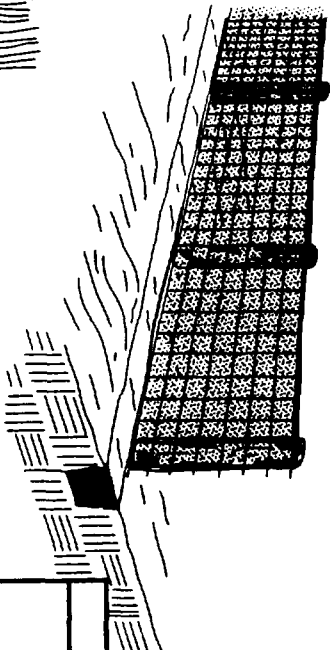


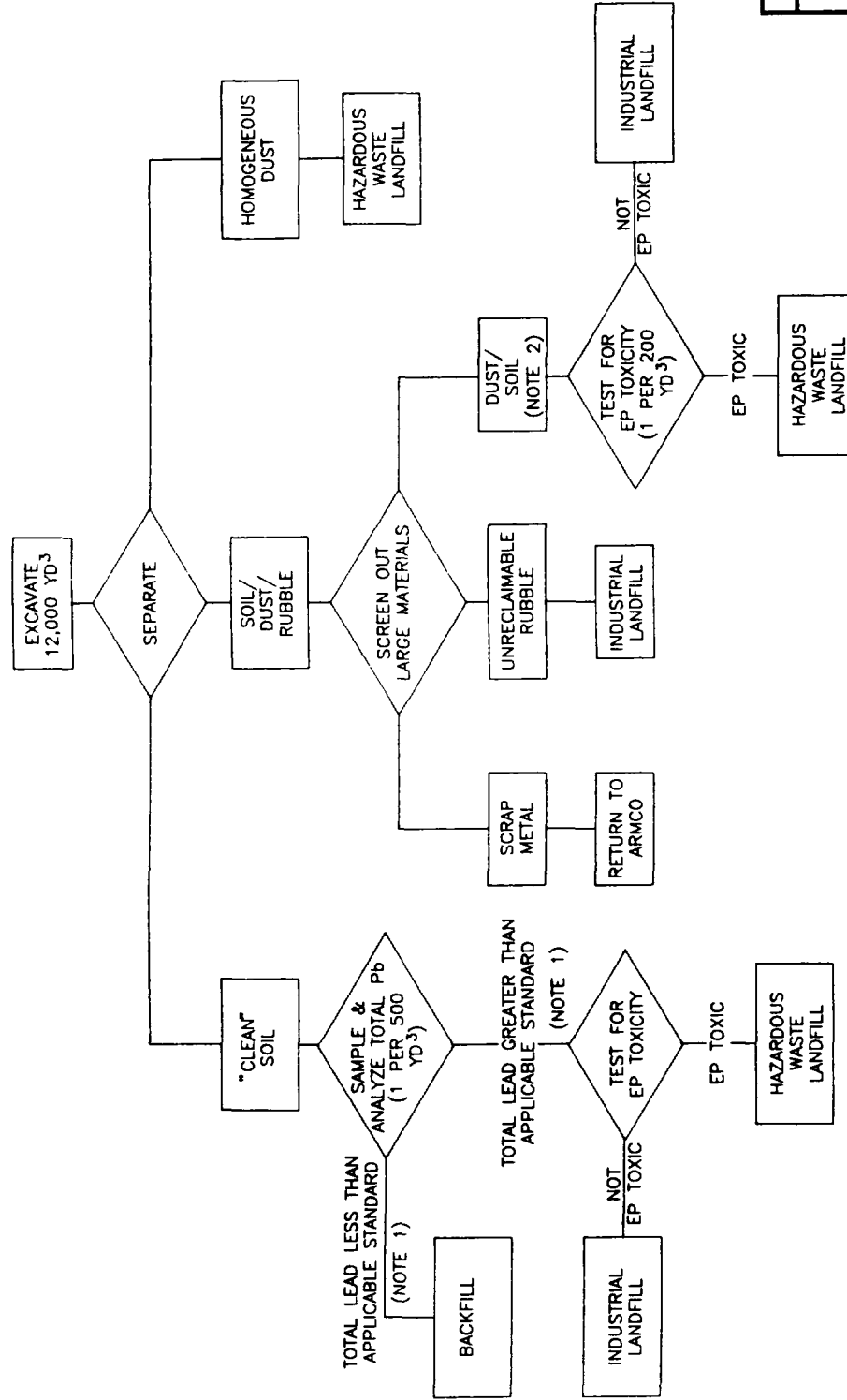
FIGURE 8
TYPICAL SILT FENCE
INSTALLATION

PREPARED FOR ARMCO INC. MIDDLETOWN, OHIO			
DRAWN	5/10/89	L.H.K.	DRAWING NUMBER
CHECKED	5/11/89	N.K.C.	89119-B7
APPROVED	5/11/89	L.H.B.	

REVS.

1	DELETE NOTE AND CHANGE TEXT. L.B.L. 11/6/89
---	---





NOTE:

1. APPENDIX H PRESENTS DEVELOPMENT OF APPLICABLE STANDARDS FOR TOTAL LEAD CONCENTRATIONS IN SOIL.
2. IF SOIL IS VISUALLY DISTINGUISHABLE AND SEPARATE FROM DUST, SOIL WILL BE TREATED AS "CLEAN" SOIL AS SHOWN ABOVE.

FIGURE 9

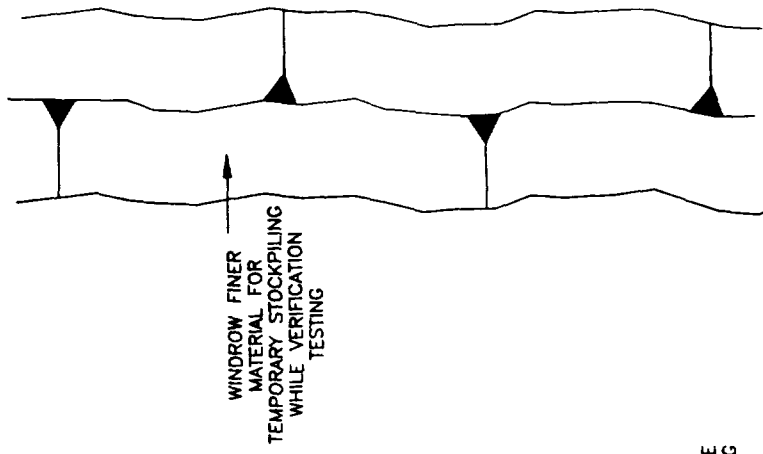
FLOW CHART, MATERIALS
HANDLING AND DISPOSITION

PREPARED FOR ARMCO INC.			
MIDDLETOWN, OHIO			
DRAWN	5/10/89	L.H.K.	DRAWING NUMBER
CHECKED	N.K.C.	6/9/89	89119-B1
APPROVED	L.M.B.	6/9/89	



REV. 2

REVS.	CHANGE IN TEXT	CHANGE IN TEXT AND ADD NOTES.
Δ	6/9/89 L.H.K.	Δ 11/6/89 L.B.L. 11/1/89



NOT TO SCALE

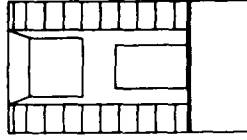
FIGURE 10

SCHEMATIC OF STAGED EXCAVATION AND SORTING

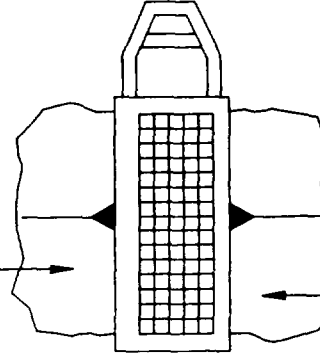
PREPARED FOR ARMCO INC. MIDDLETOWN, OHIO			DRAWING NUMBER 89119-B2	
DATE	5/1/89	L.H.K.	DATE	5/1/89
CHECKED	5/1/89	L.H.K.	APPROVED	5/1/89



TRACK
LOADER



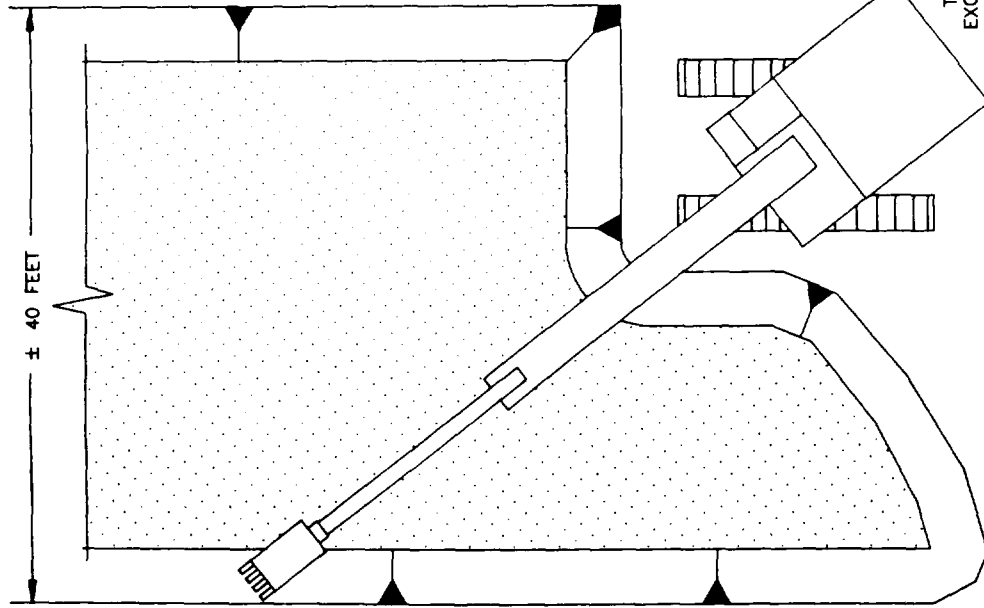
FINER
MATERIAL



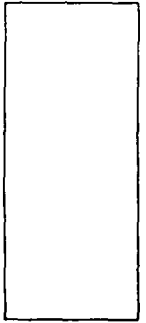
PORTABLE
VIBRATING
SCREEN

CONSTRUCTION
RUBBLE, WIRE
AND DEBRIS

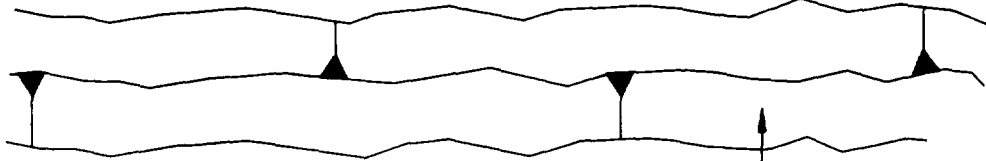
TRACK
EXCAVATOR



ROLLOFF
BOX



VISIBLY
CLEAN
SOIL



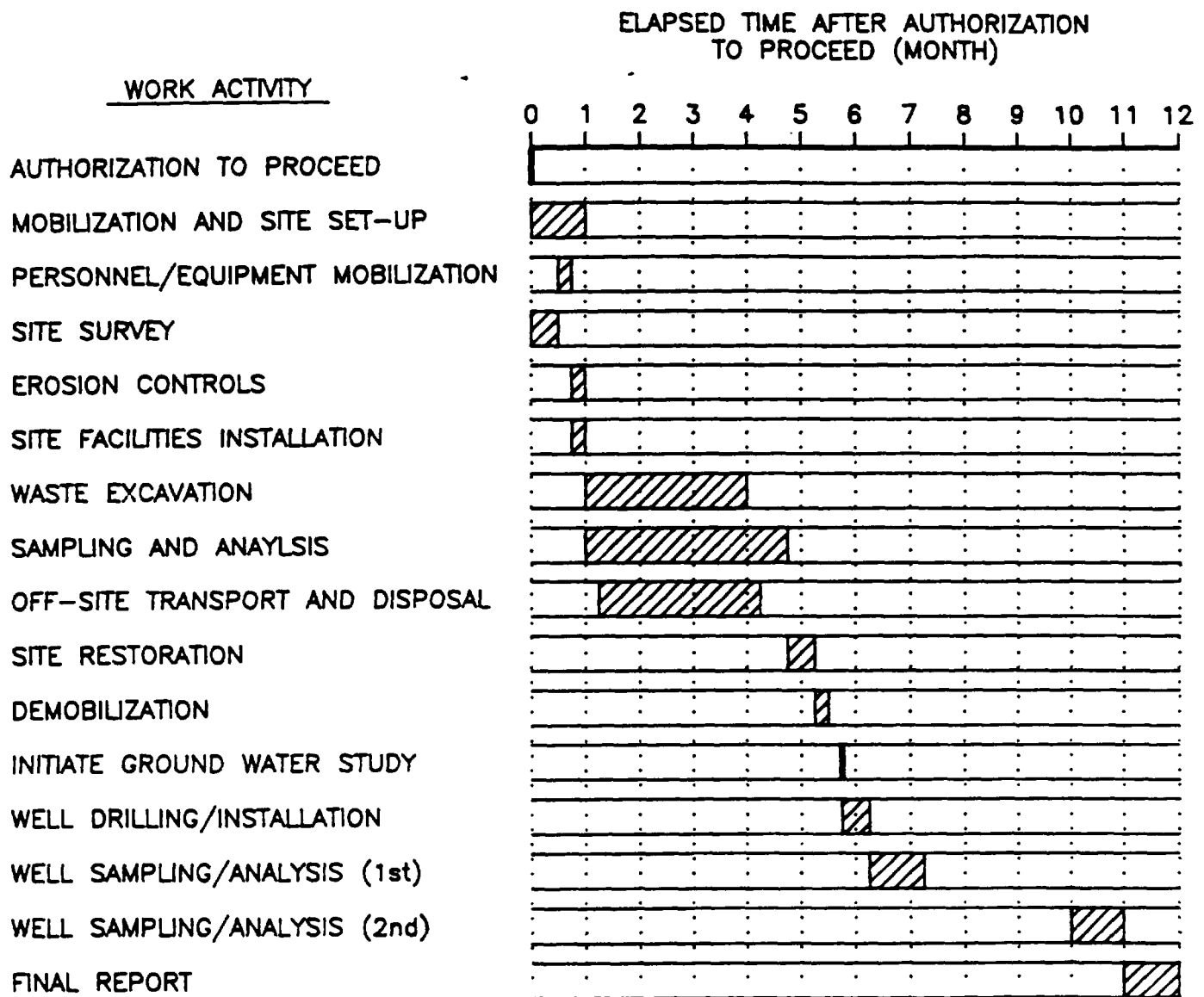


FIGURE 12

PROPOSED
PROJECT SCHEDULE

PREPARED FOR
ARMCO INC.
MIDDLETOWN, OHIO

DRAWN	C.E.B. 4/4/80	DRAWING NUMBER
CHECKED		89119-A6
APPROVED		



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APPENDIX A
TEST PIT LOGS



TEST PIT CLASSIFICATION

PROJECT NAME ARMCO - UWR PROJECT NUMBER 82423.2
FIELD ENG./GEO. D. Cowley APPROX. ELEV. 248.9
COORDINATES _____ DEPTH TO GWL _____

PAGE 1 OF 13
TEST PIT NO. TP 1A
DATE 12/15/97

DEPTH (Ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Brown Gray silty clay with some trash and general plant debris	F.11	No samples collected from test pit TP 1A
2					
3					
4					
5			Brown Silty Clay	ML	
			Bottom of test Pit - 5.0'		
6					
7					
8					
9					
10					

NOTES

No scanning of Air in test Pit → 00 ppm



TEST PIT CLASSIFICATION

PROJECT NAME ARMCO - UWR PROJECT NUMBER 87423.2
FIELD ENG./GEO. D. Crowley APPROX. ELEV. 748.9
COORDINATES _____ DEPTH TO GWL _____

PAGE 2 OF 12
TEST PIT NO. TP1B
DATE 12/5/87

DEPTH (Ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Brown silty Top Soil	3H	
2			Brown Gray silty clay with very minor amounts of scrap steel	Yellow/BW fine to coarse sand exposed East end of Test Pit	No samples collected from test pit TP1B
3					
4					
5					
6			Total Depth of Test Pit = 5.5'		
7					
8					
9					
10					

NOTES:

H₂O scanning of Air in test Pit = 0.0 ppm

TEST PIT CLASSIFICATION

PROJECT NAME ARMCO-1228 PROJECT NUMBER 47423.2
 FIELD ENG./GEO. D. Crawley APPROX. ELEV. 748.9
 COORDINATES _____ DEPTH TO GWL _____

PAGE 2 OF 13
 TEST PIT NO. TPIC
 DATE 12/18/97

DEPTH (ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Well compacted L.S. Gravel Fill		
2			Dark Brown, ^{v. thin Band (1") of Black Dust and scale} Well compacted, silty clay with some sand	CL	
3					
4			construction and misc plant debris including several drum lids		
5			Black Dust and scale		
6			cables and one crushed drum		← @ 6' Black soil w/ Fill + Dust sampled RAU-TPIC-01
7					
8			Dark Gray Silty Clay	CL	
9			Total Depth of Test P. + = 8.5'		
10					

NOTES:

Hnu scanning → 0.0 ppm
 dust created by Back hoe operations Hnu → 0.5 ppm



TEST PIT CLASSIFICATION

PROJECT NAME ARMCO - UWR PROJECT NUMBER 87423 2
FIELD ENG./GEO. D. Crowley APPROX. ELEV. 744.4
COORDINATES _____ DEPTH TO GWL _____

PAGE 4 OF 3
TEST PIT NO. TP 2
DATE 12/15/87

DEPTH (ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Brown silty top soil		
2			Black Dust and scale		
3					
4					
5					
6			Brown / Gray silty clay		
7			(non fill material)		
8				CL	
9			Total Depth of Test Pit = 8.5'		
10					

samples of Dust
collected:
RAU-TP2-02 (VOA)
RAU-TP2-03

sample of clay @ 8.5'
RAU-TP2-01

NOTES:

Had sampling of Air in test pit → 0.0 ppm



TEST PIT CLASSIFICATION

PROJECT NAME ARMCO-UWR PROJECT NUMBER 87423.2
FIELD ENG./GEO. D. Crowley APPROX. ELEV. 746.6
COORDINATES _____ DEPTH TO GWL _____

PAGE 5 OF 13
TEST PIT NO. TP 3A
DATE 12/5/87

DEPTH (Ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Brown silt w/ sand top soil		
2			1" thick band of dark red		
3			WASTE AND DEBRIS - MISC. construction debris - MISC. plant debris, (glass & wood), - Remains of 1 old drum, probably used as garbage can		
4			ISOLATED BAND OF Black DUST/POWDER		
5			- some Fe stains @ 5'		
6					
7					
8			GRAY BROWN SILT w/ CLAY (LOW FILL MATERIAL)	ML	
9			Bottom of test Pit @ 8 ft		
10					

NOTES

Hum readings of air in test pit → 0.0 ppm



TEST PIT CLASSIFICATION

PROJECT NAME ARMCC - UWR PROJECT NUMBER 87423.2
FIELD ENG./GEO. D. Crowley APPROX. ELEV. 746.6
COORDINATES _____ DEPTH TO GWL _____

PAGE 6 OF 12
TEST PIT NO. TP3B
DATE 12/15/97

DEPTH (FT)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			slag gravel and gray sand		← SAMPLE # RAU TP3B01 + Black Dust
			Black Powder, Dust & scale		
2			Dark Gray silt and clay		
3					
4			construction debris incorporated into the gray silt & clay	CL ML	
5			Total Depth of Test Pit = 5.0'		
6					
7					
8					
9					
10					

NOTES:

Hand scanning of Air in Test Pit → 00 ppm



TEST PIT CLASSIFICATION

PROJECT NAME ARMCO-UWR PROJECT NUMBER 87423.2
FIELD ENG./GEO. D Crowley APPROX. ELEV. 747.0
COORDINATES _____ DEPTH TO GWL _____

PAGE 7 OF 12
TEST PIT NO. TP4A
DATE 12/15/87

DEPT. (Ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Brown silty sand		
2			some steel wire @ 2 ft		
3					
4			Black, greasy silt, sludge like due to liquid seep from side wall @ 4.5 ft (DRAGGER TUBE (TCE) = ND)		← Sample of sludge-like material collected RAU-TP4A-01 RAU-TP4A-02 (for VOA)
5					
6			Brown silty clay with some sand	CL	
7					
8			Total Depth of Test Pit = 7.5 ft		
9					
10					

NOTES

H₂O reading of air in pit → 0.0 ppm



TEST PIT CLASSIFICATION

PROJECT NAME ARMCO - UWR PROJECT NUMBER 974232
FIELD ENG./GEO. D. Crowley APPROX. ELEV. 747.0
COORDINATES _____ DEPTH TO GWL _____

PAGE 2 OF 2
TEST PIT NO. TP4B
DATE 12/5/87

DEPTH (ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			slag Gravel		
2			WASTE AND DEBRIS MATERIAL		
3			- BLACK POWDER, DUST AND SCALE		
4			- MISC construction debris such as bricks & rubble and Gray / Brown sand with WIRE		Black dust collected for Analysis RAU-TP4B-01
5			no sludge or seeps encountered		
6					
7					
8			Gray / Brown silt with clay (non fill material).	CL/ ML	
9			Total Depth of Test Pit = 8.8 ft		
10					

NOTES

H₂O Readings of air in test Pit → 0.0 ppm



TEST PIT CLASSIFICATION

PROJECT NAME ARMY GWR PROJECT NUMBER 87423-2
FIELD ENG./GEO. D. Lowley APPROX. ELEV. -50.4
COORDINATES _____ DEPTH TO GWL _____

PAGE 9 OF 13
TEST PIT NO. TE 5A
DATE 12/16/87

DEPTH ()	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Brown SANDY TOP SOIL		
2			BLACK SILTY DUST AND SCALE		
3					
4					
5					
6			— white material included in DUST @ 6'		RAU-TB-05A-1A BLACK DUST WITH WHITE MATERIAL
7					
8			DARK GRAY SILTY CLAY	CL	
9			Total Depth of Test Pit = 8.0'		
10					

NOTES



TEST PIT CLASSIFICATION

PROJECT NAME Armed UWS PROJECT NUMBER 27423.2
FIELD ENG./GEO. D. Cowley APPROX. ELEV. 750.4
COORDINATES _____ DEPTH TO GWL _____

PAGE 12 OF 13
TEST PIT NO. TP 58
DATE _____

DEPTH (Ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Brown sand with some silt	SM	
2					
3					
4			Black Dust Encountered at East End of Test Pit		No samples collected in TP 58
5			Total Depth of Test Pit = 5.0'		
6					
7					
8					
9					
10					

NOTES:

TEST PIT CLASSIFICATION

PROJECT NAME ARMCO JWR PROJECT NUMBER 974232
FIELD ENG./GEO. D Crowley APPROX. ELEV. 749.4
COORDINATES _____ DEPTH TO GWL _____

PAGE 1 OF 13
TEST PIT NO. TP6
DATE 12/16/97

DEPTH (Ft)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Gravel and slag fill		
2			Fill including: Black Dust, Construction Debris, scrap steel Rods, some coal pieces		Thin layer of Black Dust sampled @ 1' RAJ-TP6-01
3					
4			Red Brown clay w/ some silt		
5					
6				CL CH	SAMPLE OF CLAY COLLECTED @ 6' RAJ-TP6-02
7					
8					
9			Total Depth of Test Pit = 8.5'		
10					

NOTES:



TEST PIT CLASSIFICATION

PROJECT NAME ARMCO - UWR PROJECT NUMBER 87423.2
FIELD ENG./GEO. D C Why APPROX. ELEV. 747.6
COORDINATES _____ DEPTH TO GWL _____

PAGE 12 OF 13
TEST PIT NO. TPB
DATE 12/16/87

DEPTH (FT)	SAMPLE NO. AND TYPE	SOIL PROFILE	DESCRIPTION	U.S.C.S. SYMBOL	REMARKS
1			Well compacted limestone gravel fill		RAU-TPBA-1D (DK Red sand)
2			CONCENTRATED BLACK DUST & SCALE		RAU-TPBA-1E (VGA ON DK RED)
3			BLACK DUST WITH CONSTRUCTION DEBRIS, PIECES OF WIRE, WIRE ROPE DRUM LIDS, PIECES OF STEEL		RAU-TPBA-1F (BLACK DUST & SCALE SAND)
4					RAU-TPBA-1A (WHITE SAND)
5					RAU-TPBA-1B (VGA) (WHITE SAND)
6			Brown, silty lens with gravel		@ 5.5' Exposed clay PIPE ON EAST SIDE OF PIT
7			DARK GRAY SILTY CLAY		RAU-TPBA-1C (BLACK DUST from 6 ft)
8				CL	
9					
10					

NOTES

Now scanning → 3.0-6.0 ppm in test pit
TCE Dragger Tube - ND

APPENDIX B
BORING LOGS



VISUAL CLASSIFICATION OF SOILS

OBJECT NUMBER: 85-123	PROJECT NAME: ARAD JN ON JUNE 1987		
BORING NUMBER: RAJ-137	COORDINATES: 50619 HCL TANG	DATE: 12/15/87	
ELEVATION: 749.4	GWL: Depth	Date/Time	DATE STARTED: 12/15/87
ENGINEER/GEOLOGIST: LAK	Depth	Date/Time	DATE COMPLETED: 12/15/87
DRILLING METHODS: DRIVEN SPLIT TUBES			PAGE 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6-INCH	RECOVERY (INCH)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1.0	SS A	12 50 36	10	FILL. BROWN SILTY CLAY, SOME CONCRETE CHIPS.			
2.0		7					TS7A CHEM. SAMPLE
3.0	SS B	7 12 14	8				
4.0	SS C	9 7 6	6				TS7C CHEM. SAMPLE
5.0				BOTTOM OF BORING AT 5.0 FT.			

NOTES:

1. UPON COMPLETION, BORING BACKFILLED WITH CUTTINGS.



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423	PROJECT NAME: ARMO, UNION WIRE FENCE		
BORING NUMBER: RAU-TB8	COORDINATES: 6064 HCL TANK		DATE: 12/15/87
ELEVATION: 749.3	GWL: Depth Date/Time		DATE STARTED: 12/15/87
ENGINEER/GEOLOGIST: DAH	Depth Date/Time		DATE COMPLETED: 12/15/87
DRILLING METHODS: CRANE DRILL			PAGE 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6-INCH	RECOVERY (INCH)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1.0	SS A	14 23 45	6	FILL. BROWN SILTY CLAY, SOME CONCRETE CHIPS.			
2.0	SS B	12 7 8	6				TOBA CHEN SAMPLE
3.0	SS C	9 12 11	18				
4.0		50					TOGC CHEN SAMPLE
5.0				BOTTOM OF BORING AT 5.0 FT.			

NOTES:

- UPON COMPLETION, BORING BACKFILLED WITH CUTTINGS.



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 95423	PROJECT NAME: ARMED UNION WIRE ROPE		
BORING NUMBER: RA--157	COORDINATES: ALO RINDSWATER	DATE: 2/15/87	
ELEVATION: 747.7	GWL: Depth	Date/Time	DATE STARTED: 12/15/87
ENGINEER/GEOLOGIST: OAK	Depth	Date/Time	DATE COMPLETED: 12/15/87
DRILLING METHODS: HOLLOW STEM AUGER			PAGE: 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6-INCH	RECOVERY (INCH)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
5.0	SS _A	13-15 17-17	18	FILL. BROWN F-C SANDY SILTY CLAY,			
	SS _B	6-6-5	4				
	SS _C	3-4-5	1				
	SS _D	3-5-4	4				
	SS _E	5-6-7	1				
	SS _F	5-2-3	1				
10.0	SS _G	4-3 4-5	24	BROWN FINE SANDY SILTY CLAY	CL		TS96 CHEN SAMPLE
	SS _H	4-3-5	18		CL		
	SS _I	4-4 4-4	15		CL		
15.0	SS _J	2-1 1-2	24		CL		TS95 CHEN SAMPLE
20.0				BOTTOM OF BORING AT 17.0 FT,			

NOTES:

UPON COMPLETION, BORING WAS FILLED WITH CUTTINGS,

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423		PROJECT NAME: ARMO, JAIL	
BORING NUMBER: RAU-1510		COORDINATES: AC 2 R 254W 7E 1 N 3	
ELEVATION: 746.9	GWL: Depth	Date/Time	DATE: 12/15/87
ENGINEER/GEOLOGIST: DAIS	Depth	Date/Time	DATE STARTED: 12/15/87
DRILLING METHODS: HOLEWORM FROM AUGER			DATE COMPLETED: 12/15/87
			PAGE 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6-INCH	RECOVERY (INCH)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS		
5.0	SSA	7-5.9	8	FILL. BROWN FINE SANDY SILTY CLAY, SOME CALCITE CLUMPS.					
	SSB	8-9.4	0						
	SSC	15-9.12	12	FILL. BROWN CLAYEY FINE TO COARSE SAND, GRAVEL AND CONCRETE CLUMPS.					
	SSD	14-5.6	8						
	SEE	10-4.4	3						
SSF	8-3.3	2							
10.0	SSG	76-5	4	BROWN SILTY CLAY				CL	TOBION CHEM SAMPLE
	SSH	5-5.4	6					CL	
	SSI	4-4.5	12					CL	
15.0	SSJ	4-3.4	6						CL
	SSK	3-2	24	CL					TBIOK CHEM SAMPLE
20.0				BOTTOM OF BORING AT 17.0 FT.					

NOTES:

1. UPON COMPLETION, BORING WAS FILLED WITH CUTTINGS.



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423	PROJECT NAME: ARMO, UNION LIFE R.F.E.		
BORING NUMBER: RAJ-T 1311	COORDINATES: ARMO RESULATOR		DATE: 12/16/87
ELEVATION: 747.2	GWL: Depth	Date/Time	DATE STARTED: 1/6/88
ENGINEER/GEOLOGIST: DAH	Depth	Date/Time	DATE COMPLETED: 1/6/88
DRILLING METHODS: WELSON STEEL AUGERS			PAGE 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 INCH	RECOVERY H-11	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
5.0	SSA	15-12 10-9	12	FILL.			
	SSB	7-6 8-4	8	BROWN SILTY CLAY, SOME			
	SSC	11-12 4-3	4	F.-C. SAND + GRAVEL, SOME			
	SSD	13-10 10-5	0	WOOD CHIPS, SOME WIRE.			
10.0	SS E	9-5 6-7	12	BROWN SILTY CLAY, GRAVEL FINE SAND.	CL		
	SS F	8-5-6	10		CL		TB11 F CHEM SAMPLE
	SS G	5-3-4	18		CL		
	SS H	6-3 3-4	24		CL		TB11 H CHEM SAMPLE
15.0	SS I	4-4 3-3	24		CL		TB11 I CHEM SAMPLE
20.0				BOTTOM OF BORING AT 17.0 FT,			

NOTES:

UPON COMPLETION, BORING BALANCED WITH CUTTINGS,

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 37423	PROJECT NAME: AREA 2, SOUTH WIRE ROPE	
BORING NUMBER: RAU-MW1	COORDINATES: NORTH AREA	DATE: 12/10/87
ELEVATION: 7-19.0	GWL: Depth 16.85 Date/Time 12/18/87	DATE STARTED: 12/10/87
ENGINEER/GEOLOGIST: OAK	Depth (RX) Date/Time (8:00)	DATE COMPLETED: 12/10/87
DRILLING METHODS: HOLLOW STEEL PIPE		PAGE 1 OF 1

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 16-INCH	RECOVERY (INCH)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
5.0	SS A	2-3 3-6	24	BROWN SILTY CLAY, SOME FINE TO COARSE SAND	CL		
				CONCRETE			
10.0	SS B	4-4 5-7	24	BROWN SILTY CLAY, SOME FINE SAND.	CL		
	SS C	3-5 5-6	24		CL		
15.0	SS D	4-3 5-6	0				
	SS E	2-3 3-3	24	BROWN CLAYEY SILT, SOME FINE SAND	ML		DAMP SAMPLE
	SS F	2-2 2-2	6		ML		DAMP SAMPLE
20.0	SS G	2-2 2-3	0				
	SS H	4-3 3-3	24		ML		WET SAMPLE
25.0				BOTTOM OF BORING AT 24.0 FT.			

NOTES:

- UPON COMPLETION, BORING CONVERTED INTO 2-INCH PVC
PIEZOMETER. FOR DETAILS, SEE PIEZOMETER DETAILS FE-1.



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423	PROJECT NAME: ALABAMA, JUNIOR WATER PUMP		
BORING NUMBER: RAU-MW3	COORDINATES: NORTH AREA	DATE: 12/17/87	
ELEVATION: 748.4	GWL: Depth 17.08 Date/Time 12/18/87	DATE STARTED 12/17/87	
ENGINEER/GEOLOGIST:	Depth (ft) Date/Time (8:00)	DATE COMPLETED: 12/17/87	
DRILLING METHODS: HOLLOW STEM AUGER		PAGE 1 OF 1	

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 16-INCH	RECOVERY (inch)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
5.2	SS A	3-2 2-3	12	BROWN SILTY CLAY, TRACE FINE SAND	CL		
10.0	SS B	2-2 2-3	24		CL		
15.2	SS C	3-2 3-4	18		CL		
20.2	SS D	2-1 2-3	24	BROWN CLAYEY SILT, SOME FINE SAND,	ML		
	SS E	3-3 3-4	24		ML		WET SAMPLE
25.0				BOTTOM OF BORING AT 24.0 FT,			

NOTES:

- UPON COMPLETION, BORING CONVERTED INTO 2-INCH PVC
PIEZOMETER, FOR DETAILS, SEE PIEZOMETER DETAILS P.E. 3.

HEMCO VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423	PROJECT NAME: LIME, UNION WIRE PIPE		
BORING NUMBER: 1-AU-MW2	COORDINATES: NORTH 1174	DATE: 12/17/87	
ELEVATION: 749.2	GWL: Depth: 7.74 Date/Time: 1/18/88	DATE STARTED: 2/17/87	
ENGINEER/GEOLOGIST: DAK	Depth (100) Date/Time (8:00)	DATE COMPLETED: 12/17/87	
DRILLING METHODS: FOLLOW STEIN JOSEPH			PAGE 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6-INCH)	RECOVERY (INCH)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
5.0	SS A	6-10 4-2	6	FILL BROWN SILTY CLAY, SOME CONCRETE CHIPS, SOME BITS OF WIRE.	CL		
10.0	SS B	3-3 7-10	24	BROWN SILTY CLAY	CL		
15.0	SS C	3-2 3-4	24	BROWN CLAYEY SILT	ML		
20.0	SS D	2-2 1-2	24		ML		DAMP SAMPLE
	SS E	2-2 2-2	24		ML		WET SAMPLE
25.2				BOTTOM OF BORING AT 24.0 FT			

NOTES:

UPON COMPLETION, BORING CONVERTED INTO 2-INCH PVC
PIEZOMETER. FOR DETAILS, SEE PIEZOMETER DETAILS PE-2.



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 88630	PROJECT NAME: Union Wire Rope GW Monitoring?		
BORING NUMBER: MW-3A	COORDINATES:	DATE: 12/19/88	
ELEVATION: 750.1	GWL: Depth 15.3 Date/Time 11/13/88	DATE STARTED 11/12/88	
ENGINEER/GEOLOGIST: D. Crowley	Depth	Date/Time	DATE COMPLETED 11/17/88
DRILLING METHODS: Hollow Stem Auger			PAGE 1 OF 1

DEPTH (ft)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER FOOT	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
5	S-1	8	40	TAN, Dry, Medium Sand and Gravel Fill	ML		
				Dark Gray, Damp, Medium stiff, silt w/ clay, some Fe staining and plant fragments			
10	S-2	9	80	- Dark gray/Brown, Damp, Medium stiff silt and clay with some plant fragments	MH/CL		
				- Dark Gray/Brown, Moist Medium stiff silt and clay trace very fine sand (wet sandy lenses)			
15	S-3	7	90				
20	S-4	6	100				
25				Bottom of Boring @ 25'			

NOTES:

2" PVC monitoring well constructed.



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423.13	PROJECT NAME: ARMCO UNION WIRE ROPE		
BORING NUMBER: MW-4	COORDINATES:		DATE: 1/20/88
ELEVATION: 749.5	GWL: Depth	Date/Time	DATE STARTED: 1/19/88
ENGINEER/GEOLOGIST: D. Crowley	Depth	Date/Time	DATE COMPLETED: 1/19/88
DRILLING METHODS: Hollow Stem Auger w/ CONCRETE Casing			PAGE 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 1 FOOT	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				CONCRETE (2" THICK)			
	SS 4A	NA	100	STIFF, DRY TO DAMP, DARK GRAY, SILTY CLAY, WITH SOME WHITE COLOR IN PORE SPACES	CL		RAU-MS-004-1A SAMPLE 1.0-1.5
5	SS 43	NA	90	DRY TO DAMP, DARK GRAY, SILTY CLAY			RAU-MS-004-1B SAMPLE 4.0-4.5
10							
	SS 4C	NA	100	MOIST MEDIUM GRAY, CLAYEY SILT WITH TRACE PLANT FRAGMENTS "WET 1/2" BAND OF SILT	ML		
15							
20	SS 4D	NA	80	DAMP-MOIST, MEDIUM GRAY, CLAYEY SILT WITH ABUNDANT PLANT FRAGMENTS			
25				Total Depth of Boring: 24.0 ft			

NOTES:

MONITORING WELL CONSTRUCTED IN BORING, SEE MONITORING WELL
CONSTRUCTION SCHEMATIC (MW-4)



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423.13	PROJECT NAME: ARMCO UNION WIRE ROPE	
BORING NUMBER: MW-5	COORDINATES:	DATE: 1/20/58
ELEVATION: 750.3	GWL: Depth 19.7 Date/Time UPON COMPLETION OF WELL	DATE STARTED: 1/18/58
ENGINEER/GEOLOGIST: D. Crowley	Depth Date/Time	DATE COMPLETED: 1/18/58
DRILLING METHODS: hollow stem augers w/ concrete		PAGE 1 OF 1

DEPTH (FEET)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 1 FOOT	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				CONCRETE (6" THICK)			
	SS SB	NA	75	STIFF, DAMP, DARK GRAY SILTY CLAY	CL		RAU-MS-005-1A SAMPLE 1.0-1.5
5	SS SB	NA	80	STIFF, DAMP, DARK GRAY, SILTY CLAY W/ SOME FE STAINING			RAU-MS-005-1B SAMPLE 4.0-4.5
10							
15	SS SC	NA	90	SOFT, MOIST, BROWN/GRAY, CLAYEY SILT WITH SOME PLANT REMAINS	ML		RAU-MS-005-1C SAMPLE 15.0-15.5
20							
25				Total Depth of Boring 22.0'			

NOTES:

MONITORING WELL CONSTRUCTED IN BORING, SEE NOTES FOR
WELL CONSTRUCTIONAL CONSIDERATIONS



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423.13	PROJECT NAME: REMCO UNION W.R.F. ROPE	
BORING NUMBER: MW-6	COORDINATES:	DATE: 1/20/88
ELEVATION: 750.6	GWL: Depth 1.1 Date/Time 1/2/88	DATE STARTED: 1/8/88
ENGINEER/GEOLOGIST: D. Crowley	Depth Date/Time	DATE COMPLETED: 1/6/88
DRILLING METHODS: Hollow Stem Auger w/ Concrete coring		PAGE 1 OF 1

DEPTH (ft)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (FOOT)	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				CONCRETE (3" THICK)			
	SS 6A	NA	80	STIFF, DARK GRAY, DAMP CLAYEY SILT with trace sand			RAU-MS-006-1A AND RAU-MS-006A-1A (REPLICATE) sample 1.0-1.5 ft
5	SS 6B	NA	100	STIFF, DAMP, DARK GRAY clayey silt	ML		RAU-MS-006-1B sample 4.0-4.5 ft
10				STIFF, DAMP, DARK GRAY, SILTY CLAY	CL		
15	SS 6C	NA	80	sharp contact SOFT, MOIST, light Gray/Brown silt with clay			WATER @ 15.0 ft RAU-MS-006-1C SAMPLE 15.0-15.5
20					ML		
25				Total Depth of Boring = 25.0'			

NOTES:

MONITORING WELL CONSTRUCTED IN BORING, SEE MONITORING WELL
CONSTRUCTION SCHEMATIC (MW-6)



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423 3	PROJECT NAME: ARMCO UNION WIRE ROPE		
BORING NUMBER: MW-7	COORDINATES:	DATE: 1/18/88	
ELEVATION: 750.5	GWL: Depth 8.0 Date/Time 1/7/88	DATE STARTED: 1/7/88	
ENGINEER/GEOLOGIST: D Crowley	Depth Date/Time	DATE COMPLETED: 1/7/88	
DRILLING METHODS: Hollow stem Auger		PAGE 1	OF 1

DEPTH (ft)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (ft)	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				COARSE Limestone Gravel to FINE Limestone Gravel w/ Limestone sand	GP GW		
5	SS 7A	42	75	GRAY, MOIST TO WET, SILTY SAND AND GRAVEL OF LIMESTONE ORIGINS (FILL)	SW		
10	SS 7B	8	30	Medium stiff, dry-damp, Mottled Dark Gray, silty clay with plant remains			
15	SS 7C	8	100	MOIST, GRAY/BLACK, moist SILTY CLAY			RAJ-MS-007-1C COLLECTED @ 15.0-15.5
20	SS 7D	6	90	Med. stiff, moist to wet, Dark Gray, silt w/ clay and trace very fine sand -occasional sand lenses with water			WATER @ APPROX 17'
25				Total Depth of Boring: 23.5'			

NOTES:

MONITORING WELL CONSTRUCTED IN BORING, SEE MONITORING WELL
CONSTRUCTION SCHEMATIC (MW-7)



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 87423.13	PROJECT NAME: AKMCO UNION WIRE ROPE	
BORING NUMBER: MW-8	COORDINATES:	DATE: 1/18/88
ELEVATION: 750.3	GWL: Depth 12.8 Date/Time 1/7/88	DATE STARTED: 1/7/88
ENGINEER/GEOLOGIST: D. Crowley	Depth Date/Time	DATE COMPLETED: 1-88
DRILLING METHODS: Hollow Stem Auger		PAGE 1 OF 1

DEPTH (ft.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (Foot)	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				Asphaltic Pavement (2")			
	SS 8A	7	80	Loose SANDY GRAVEL FILL (Asphalt Odor) SOFT, DAMP, BROWN to GRAY Fe stain MOTTLED, CLAY/SILT MIX			RAU-MS-008-1A collected @ 1.3'-1.8'
5	SS 8B	6	70	Moist, Damp, Dark Gray/Red Brown MOTTLED silt with clay, trace SAND (odorless)			
10	SS 8C	7	10	Medium soft, Brown silt with medium SAND AND TRACE SANDSTONE chips			
15	SS 8D	10	80	Loose to Dense, Red-Brown/Gray, Wet fine sand, with silt - to some silt			Water @ 14.5'
20	SS 8E	4	75	Loose, wet, Green Glau. SD. w/ clay lenses Loose, moist, SILTY, SAND WITH PLANT FRAGMENTS			
25				Total Depth of Boring: 22.5'			

NOTES:

Monitoring well constructed in Boring, SEE MONITORING WELL
CONSTRUCTION SCHEMATIC (MW-8)



VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 38630	PROJECT NAME: Union Wire Rope S.W. Monitoring		
BORING NUMBER: MW-9	COORDINATES:	DATE: 12/22/88	
ELEVATION: 750.7	GWL: Depth 10.3	Date/Time 11/18/88	DATE STARTED: 11/17/88
ENGINEER/GEOLOGIST: D. Crowley	Depth	Date/Time	DATE COMPLETED: 11/17/88
DRILLING METHODS: Hollow Stem Auger			PAGE 1 OF 1

DEPTH (Feet)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (Foot)	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				TAN SAND AND GRAVEL FILL			
5	S-1	13	30	Dark Gray/Brown, stiff silt and clay with trace sand, some plant fragments, damp	ML/CL		
10	S-2	13	60	Gray/Brown, damp to moist, stiff, silt and clay, trace sand some plant fragments			Water level 10.3 (24 hr after installing well)
15	S-3	5	100	Gray/Brown, moist to wet, soft silt and sand, trace to some clay, plant fragments, some mottling	ML		
20	S-4	8	100	Gray/Brown, wet, silt and sand with trace clay, some plant fragments			
25				Total Depth of Boring = 24.5'			

NOTES:

2" Monitoring well constructed

APPENDIX C
WELL INSTALLATION DIAGRAMS

TABLE C-1
MONITORING WELL CONSTRUCTION SUMMARY

WELL NO. (1)	MEASURING POINT ELEVATION (ft-msl)	GROUND SURFACE ELEVATION (ft-msl)	WELL DEPTH (feet) (2)	SCREENED INTERVAL (feet) (2)	BOTTOM OF SEAL (feet) (2)	AREA
MW-1	751.08	749.0	24.0	23.0 to 18.0	16.0	North End
MW-2	751.18	749.2	24.0	23.0 to 18.0	16.0	North End
MW-3	751.42	749.4	24.0	23.0 to 18.0	16.0	North End
MW-3A	753.20	750.1	25.0	24.5 to 19.5	14.5	North End
MW-4	749.46	749.5	23.0	22.5 to 17.5	15.0	Building 45
MW-5	750.29	750.3	26.5	25.5 to 20.5	12.5	Near Cleaning House
MW-6	750.55	750.6	25.0	21.0 to 16.0	9.5	Patenting Department
MW-7	751.53	750.5	23.5	23.0 to 18.0	13.5	Pickle Liquor Storage Area
MW-8	753.31	750.3	22.5	22.0 to 17.0	14.0	Office Parking Lot
MW-9	753.41	750.1	24.5	22.0 to 17.0	15.0	South of Building 35

(1) For well locations, see Figure 4.

(2) Measured from ground surface.

TABLE C-2
GROUND WATER ELEVATION DATA
JANUARY 1988 THROUGH SEPTEMBER 1989

WELL NO.	GROUND WATER ELEVATION ⁽²⁾ (ft-msl)										
	JAN 08	FEB 11	MAR 31	APR 07	AUG 28	NOV 18	JAN 25	MAY 12	SEP 21		
MW-1	734.61	734.02	NR ⁽³⁾	735.53	733.86	735.07	734.35	734.08	735.90		
MW-2	733.76	733.22	NR	734.52	732.94	733.95	733.25	732.98	734.75		
MW-3	733.96	733.44	NR	734.87	732.98	734.27	733.44	733.02	735.13		
MW-3A	NA ⁽⁴⁾	NA	NA	NA	NA	734.79	733.70	733.50	735.90		
MW-4	738.69	741.85	738.01	738.88	737.65	738.06	737.80	738.06	740.11		
MW-5	743.24	742.37	NR	743.01	742.59	742.64	742.84	743.29	744.07		
MW-6	793.47	742.47	NR	742.65	741.07	742.29	741.85	742.25	744.68		
MW-7	746.86	745.50	NR	747.91	743.39	746.26	745.01	745.53	747.99		
MW-8	739.28	738.81	NR	739.61	738.10	738.28	737.94	738.51	739.77		
MW-9	NA	NA	NA	NA	NA	743.09	742.11	742.71	745.75		

(1) For well locations, see Figure 4.

(2) For well installation data summary, see Table C-1.

(3) "NR" indicates not recorded.

(4) "NA" indicates not available (well not yet installed).

REMCOR

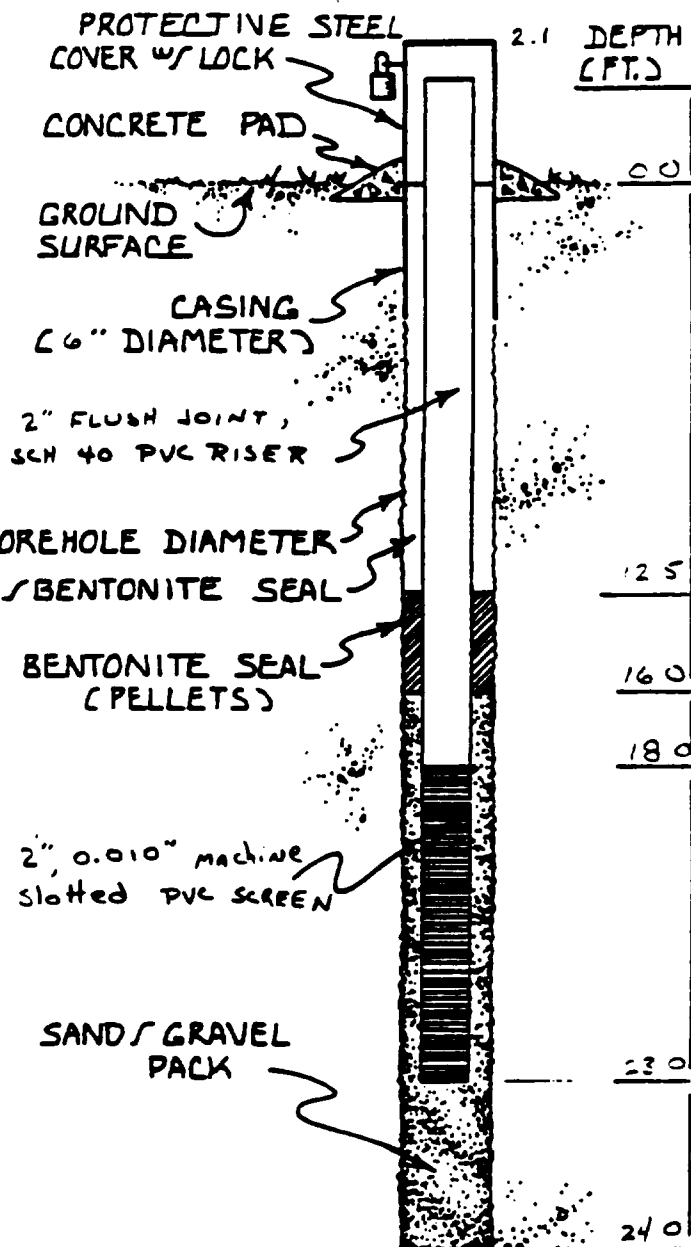
WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Well drilled near North End
Former Disposal Area,
Down gradient of Plant

Well Lock # 3358



MONITORING WELL NO. MW-1

PROJECT NAME ARMCO UNION WIRE ROPE

PROJECT NO. 87423.13

LOCATION Down Gradient of Plant near North End Former Disposal Area

GEOLOGIST D. Kachenderfer

DRILLING CONTRACTOR Layne Western

DRILLER Eric Blank

DRILLING METHOD Hollow Stem Auger

DRILLING DATE 12/17/87

GROUND ELEVATION 749.0

TOP ELEVATION 751.08

STATIC WATER DEPTH 16.85

WATER ELEVATION 734.23

DATE 12/18/87

REMCOR

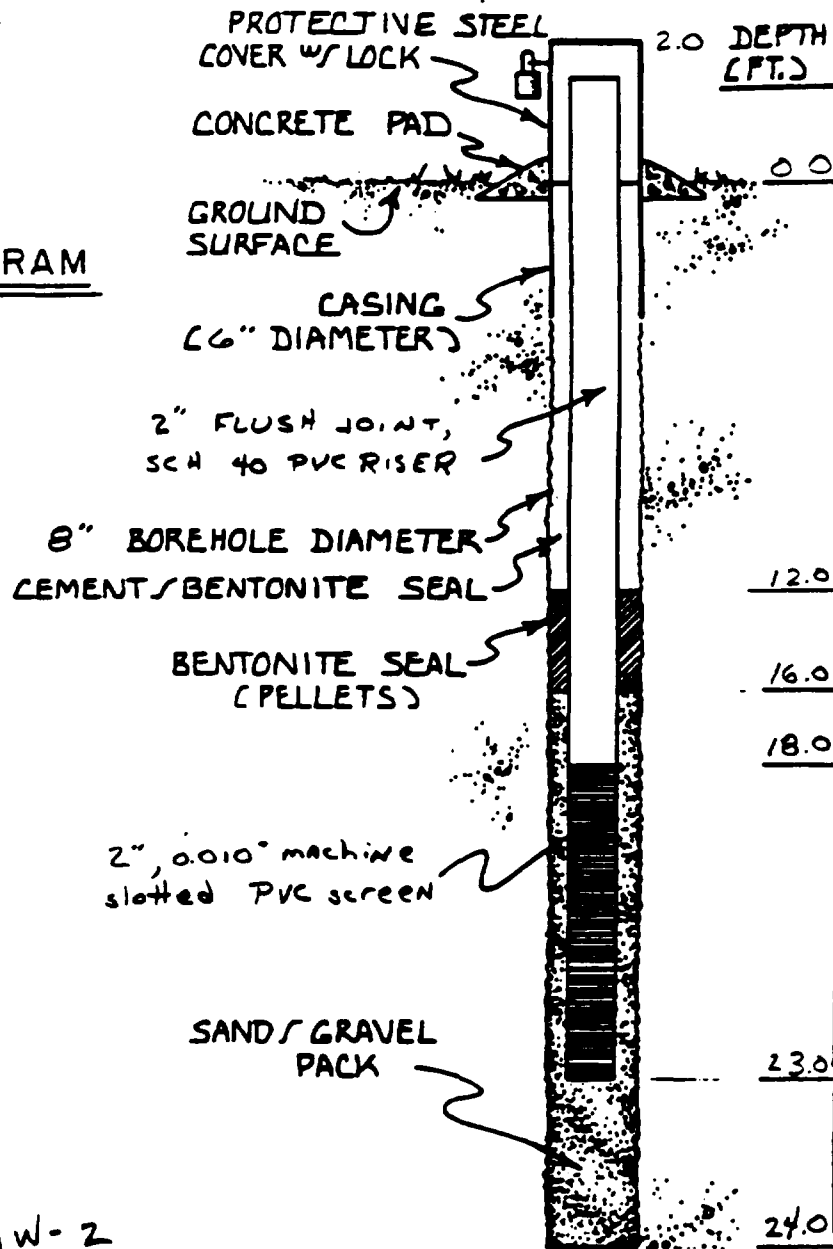
WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Well constructed down gradient
of plant in south central
portion of North End Former
Disposal Area

Well Lock # 3358



MONITORING WELL NO. MW-2

PROJECT NAME ARMCO UNION WIRE ROPE

PROJECT NO. 87423.13

LOCATION Down gradient of Plant at south central portion of Former
GEOLOGIST D. Kochendorfer Disposal Area.

DRILLING CONTRACTOR Layne Western

DRILLER Buck Blank

DRILLING METHOD Hollow Stem Auger.

DRILLING DATE 12/17/87

GROUND ELEVATION 749.2

TOP ELEVATION 751.18

STATIC WATER DEPTH 17.74

WATER ELEVATION 733.44

DATE 12/18/87



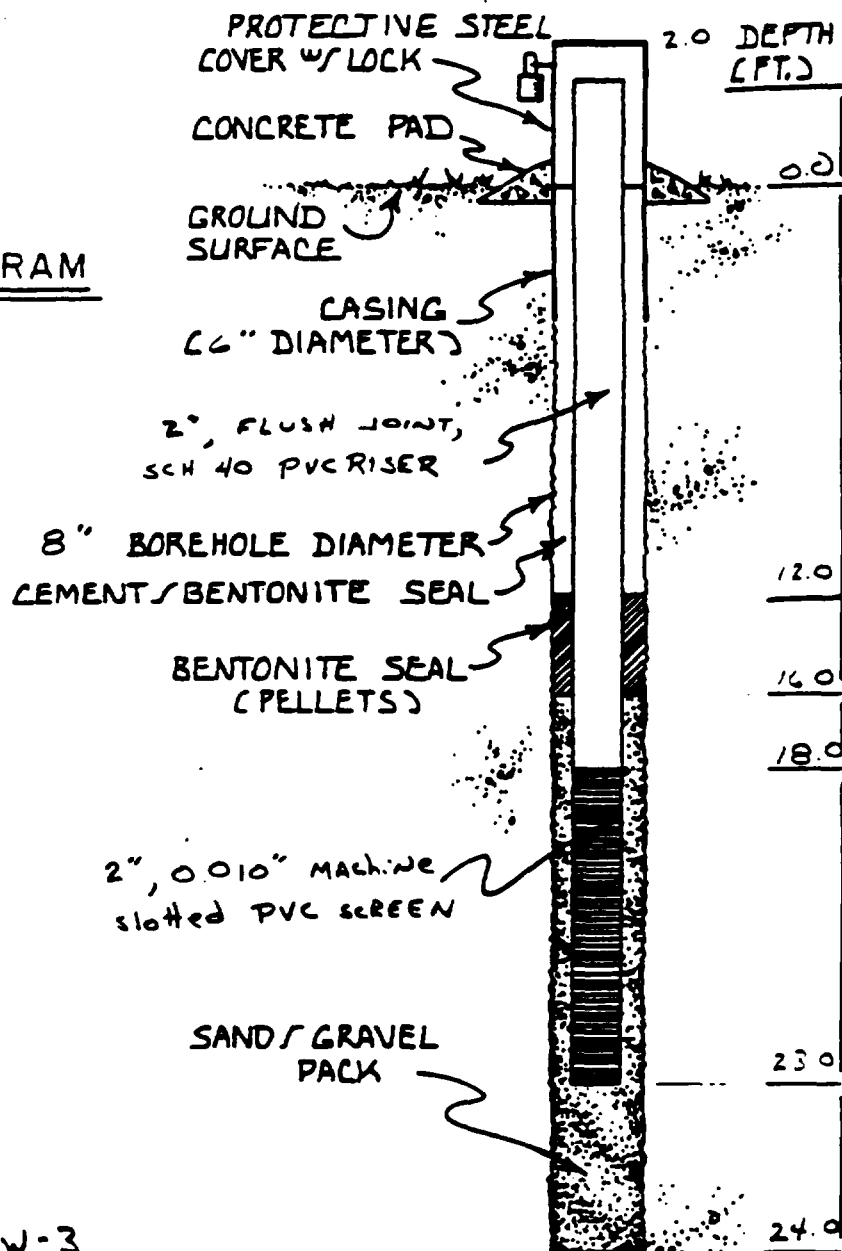
WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Well located at North
West corner of ARMCO
PROPERTY, apparently
CROSS-GRADIENT OF
PLANT

LOCK # 3358



MONITORING WELL NO. MW-3

PROJECT NAME ARMCO, UNION WIRE ROPE

PROJECT NO. 87423.13

LOCATION AT NORTH WEST CORNER OF PLANT PROPERTY

GEOLOGIST D. Kneuderfer

DRILLING CONTRACTOR Layne Western

DRILLER Buck Blank

DRILLING METHOD Hollow Stem Auger

DRILLING DATE 12/17/87

GROUND ELEVATION 749.4

TOP ELEVATION 751.42

STATIC WATER DEPTH 17.08

WATER ELEVATION 734.34

DATE 12/18/87

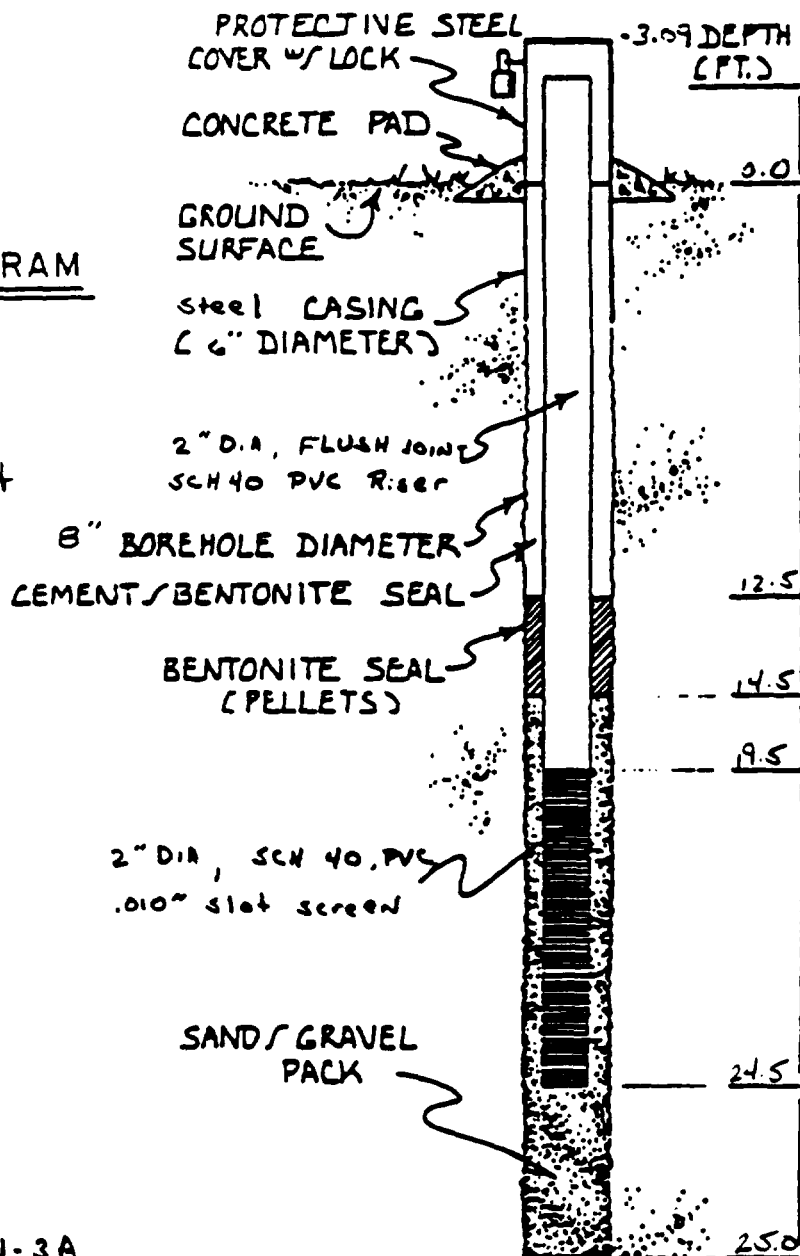


WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Well drilled to be Replacement
for MW-3 when COE
begins Rechannelization
of Blue River and most
likely Removes MW-3.



MONITORING WELL NO. MW-3A

PROJECT NAME ARMCO Union Wire Rope

PROJECT NO. BB630

LOCATION Approx 70 ft south of MW-3, outside Blue R. Rechannelization limits

GEOLOGIST D. Crowley

DRILLING CONTRACTOR Layne Western

DRILLER Buck Black

DRILLING METHOD Hollow Stem Auger

DRILLING DATE 11/17/88

GROUND ELEVATION 750.1

TOP ELEVATION 753.20

STATIC WATER DEPTH 15.3 (G.S.)

WATER ELEVATION 737.79

DATE 11/18/88



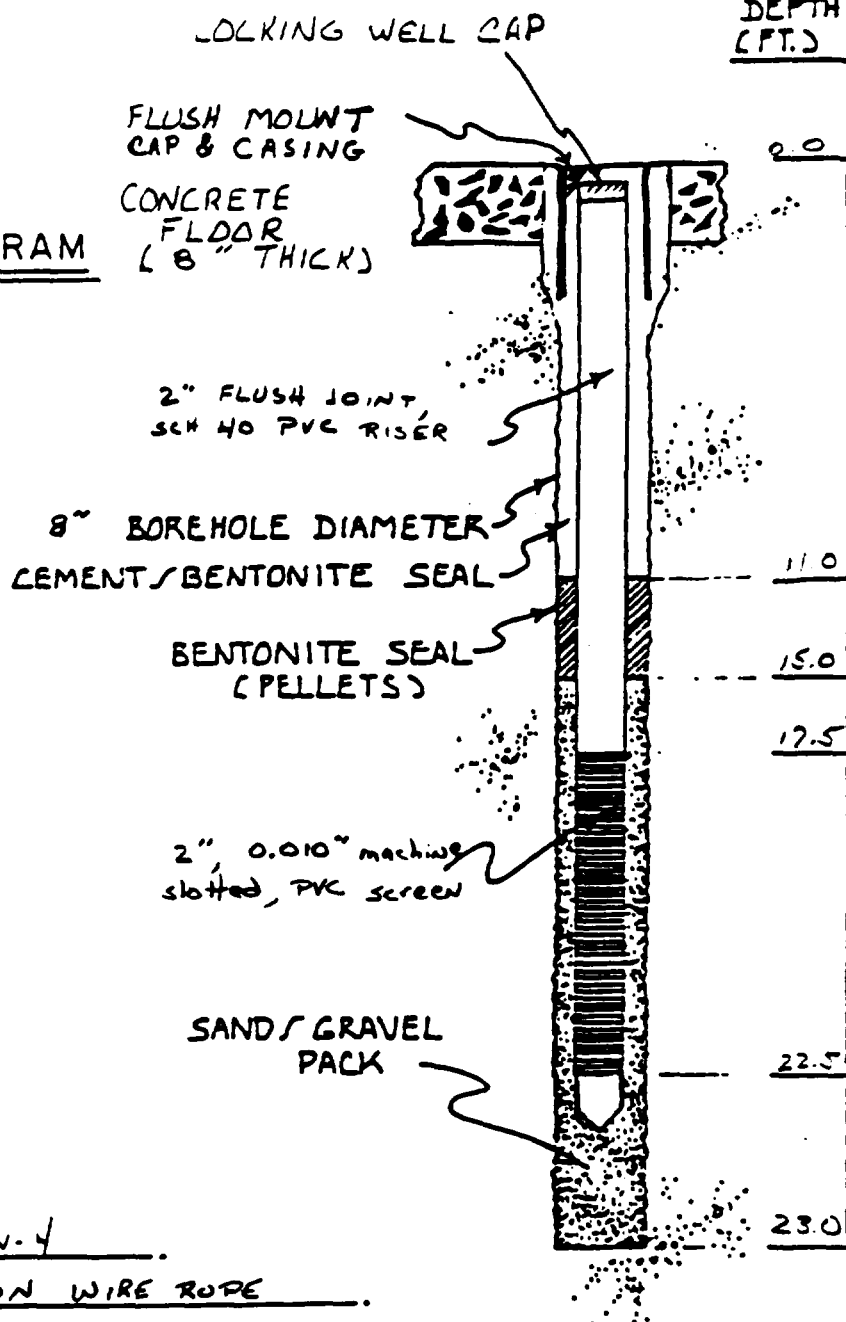
WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Flush mount construction
Well with locking cap.
- Lock # 3358

Well Drilled inside building
45 after coming through
CONCRETE FLOOR.



MONITORING WELL NO. MW-4

PROJECT NAME ARMCO UNION WIRE ROPE

PROJECT NO. 87423.13

LOCATION Building 45, ~10 ft East of #7 Galvanizing Furnace

GEOLOGIST D. Crowley

DRILLING CONTRACTOR Layne Western

DRILLER Beck Blank

DRILLING METHOD Hollow Stem Auger

DRILLING DATE 1/9/88

GROUND ELEVATION 749.5

TOP ELEVATION 749.46

STATIC WATER DEPTH 10.77

WATER ELEVATION 738.69

DATE 1/10/88



WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

FLUSH MOUNT CONSTRUCTION WELL
WITH LOCKING CAP

- LOCK # 3358

Well Drilled inside wire
storage building near
cleaning house after
coming through concrete floor

8" BOREHOLE DIAMETER
CEMENT/BENTONITE SEAL

BENTONITE SEAL
(PELLETS)

2" DIA, 0.010"
machine slotted
PVC, screen

SAND/ GRAVEL
PACK

LOCKING WELL CAP

FLUSH MOUNT
CAP & CASING

CONCRETE
FLOOR
(6" THICK)

2" FLUSH JOINT
SCH 40 PVC RISER

DEPTH
(FT.)

0.0

10.5

12.5

20.5

25.5

26.5

MONITORING WELL NO. MW-5

PROJECT NAME ARMCO UNION WIRE ROPE

PROJECT NO. 97423.13

LOCATION Building 1, ~10 ft North of cleaning house building

GEOLOGIST D. Crowley

DRILLING CONTRACTOR Layne Western

DRILLER Rock Blank

DRILLING METHOD Hollow Stem Auger

DRILLING DATE 1/8/88

GROUND ELEVATION 750.3

TOP ELEVATION 750.29

STATIC WATER DEPTH 7.05

WATER ELEVATION 743.24

DATE 1/10/98



WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

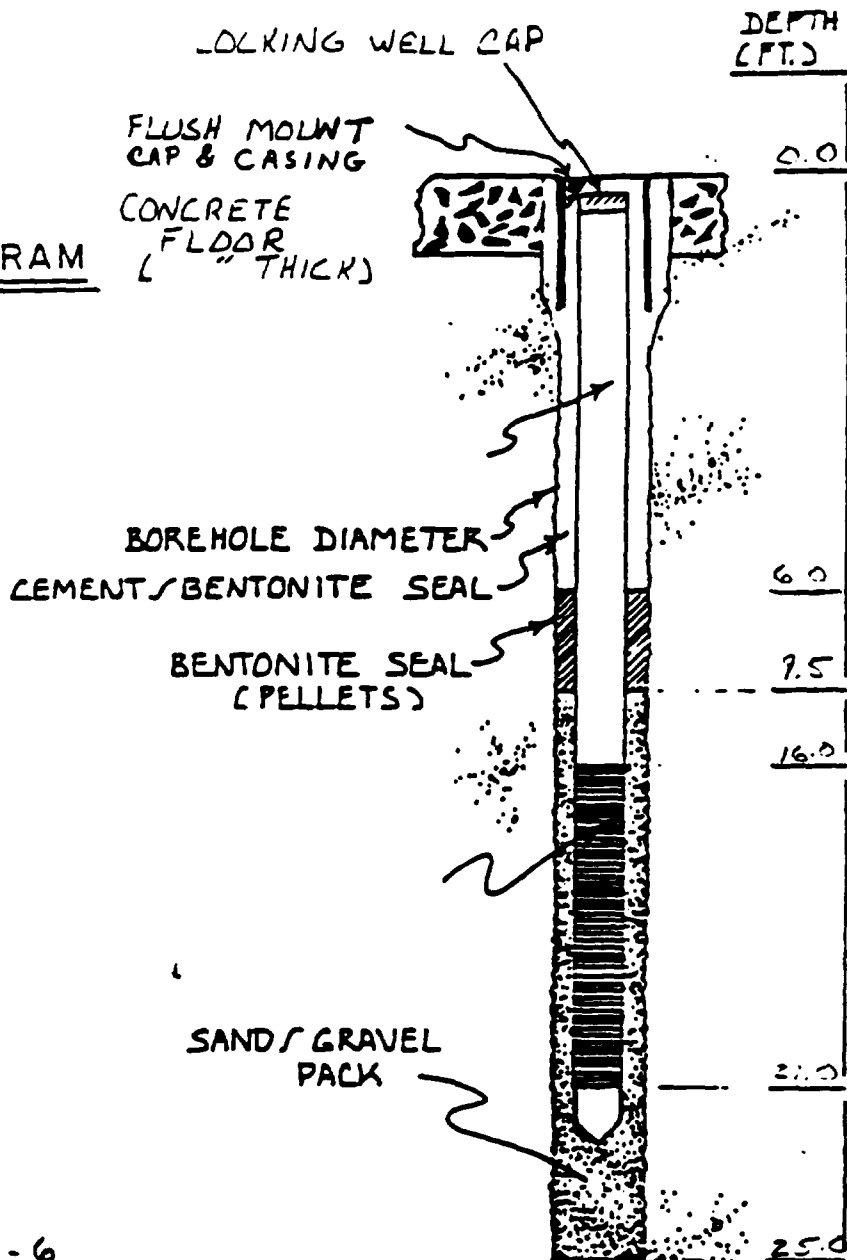
Flush mount construction well

with Locking Cap

- Lock # 3358

Well Drilled inside building

11 41/42 After casing through
concrete.



MONITORING WELL NO. MW-6

PROJECT NAME ARMCO UNION WIRE ROPE

PROJECT NO. B7423.13

LOCATION Buildings 41/42 at North End Approx 100 ft north of Factory

GEOLOGIST D. Crowley

DRILLING CONTRACTOR Layne Western

DRILLER Buck Blank

DRILLING METHOD Hollow stem Auger

DRILLING DATE 1/9/88

GROUND ELEVATION 750.55

TOP ELEVATION 750.6

STATIC WATER DEPTH 7.08

WATER ELEVATION 743.47

DATE 1/10/88



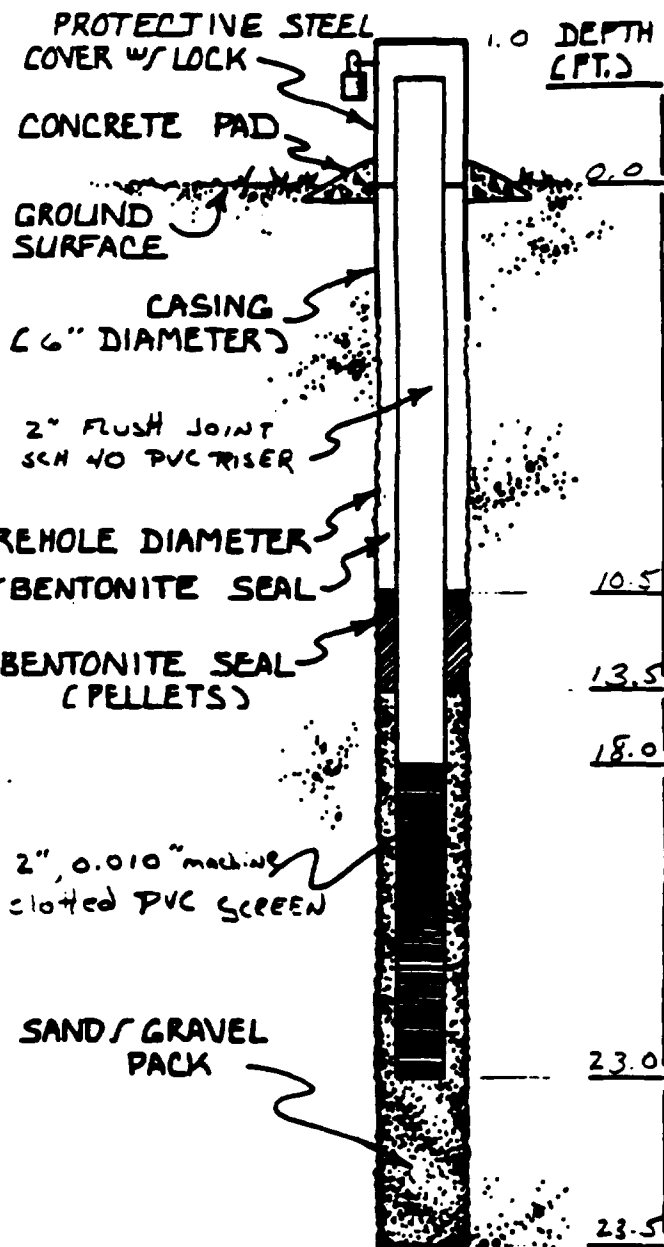
WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Well was originally constructed with a 2.5' stick-up (pro cover) but interfered w/ plant operations. Stick up was modified by plant personnel by cutting off 1.50'. The stick up is now 1.0' above ground surface.

Well Lock #3358



MONITORING WELL NO. MW- 7

PROJECT NAME PRMCO UNION WIRE ROPE

PROJECT NO. 87423.13

LOCATION At spent Pickle liquor Area near Propane Filling station

GEOLOGIST D. Crowley

DRILLING CONTRACTOR Layne Western

DRILLER Buck Blank

DRILLING METHOD Hollow Stem Auger

DRILLING DATE 1/7/88

GROUND ELEVATION 750.5

TOP ELEVATION 751.53

STATIC WATER DEPTH 4.67

WATER ELEVATION 746.86

DATE 1/10/88

REMCOR

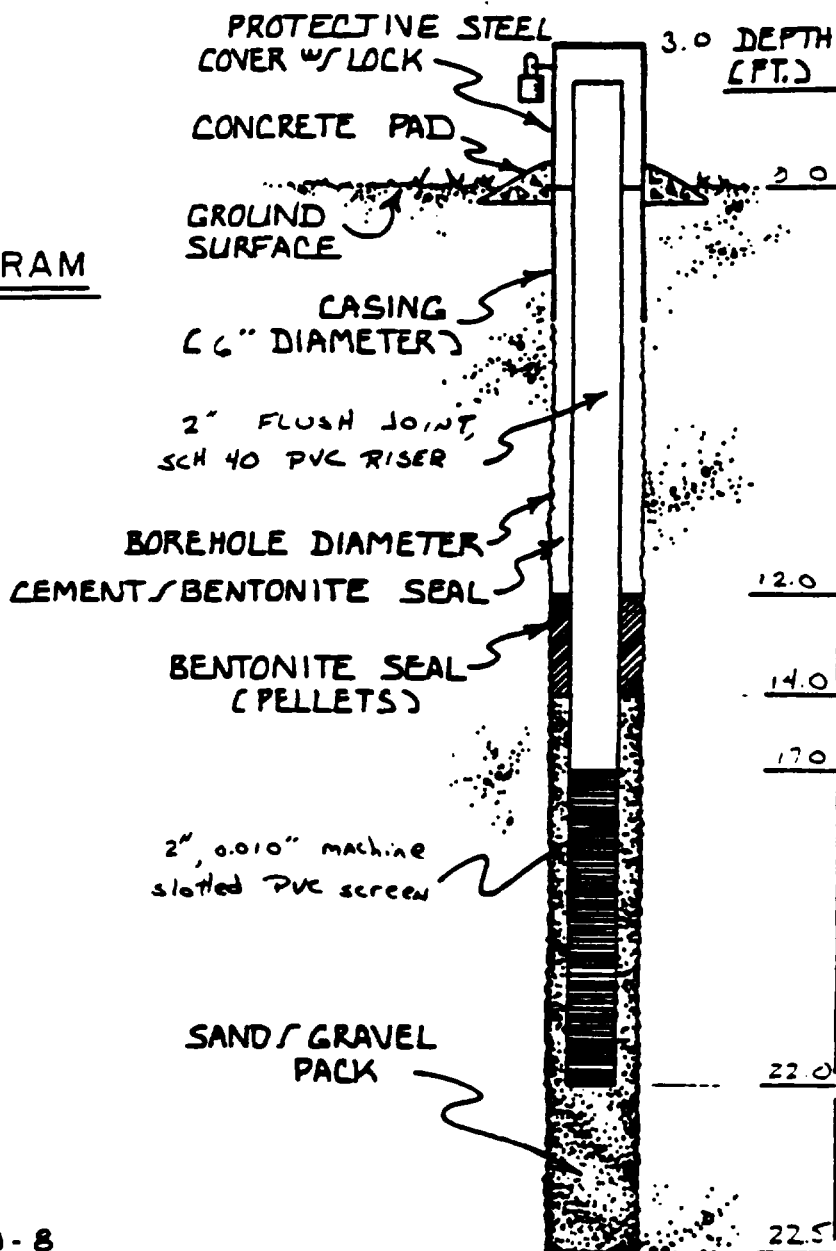
WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Well drilled behind office
as background well.

Well Lock #3358



MONITORING WELL NO. MW-8

PROJECT NAME ARMCO UNION WIRE ROPE

PROJECT NO. 87423.13

LOCATION IN SOUTH EAST CORNER OF OFFICE PARKING LOT

GEOLOGIST D. Crowley

DRILLING CONTRACTOR Wayne Western

DRILLER Buck Blank

DRILLING METHOD Hollow Stem Auger

DRILLING DATE 1/7/88

GROUND ELEVATION 750.3

TOP ELEVATION 753.31

STATIC WATER DEPTH 14.03

WATER ELEVATION 739.28

DATE 1/10/88

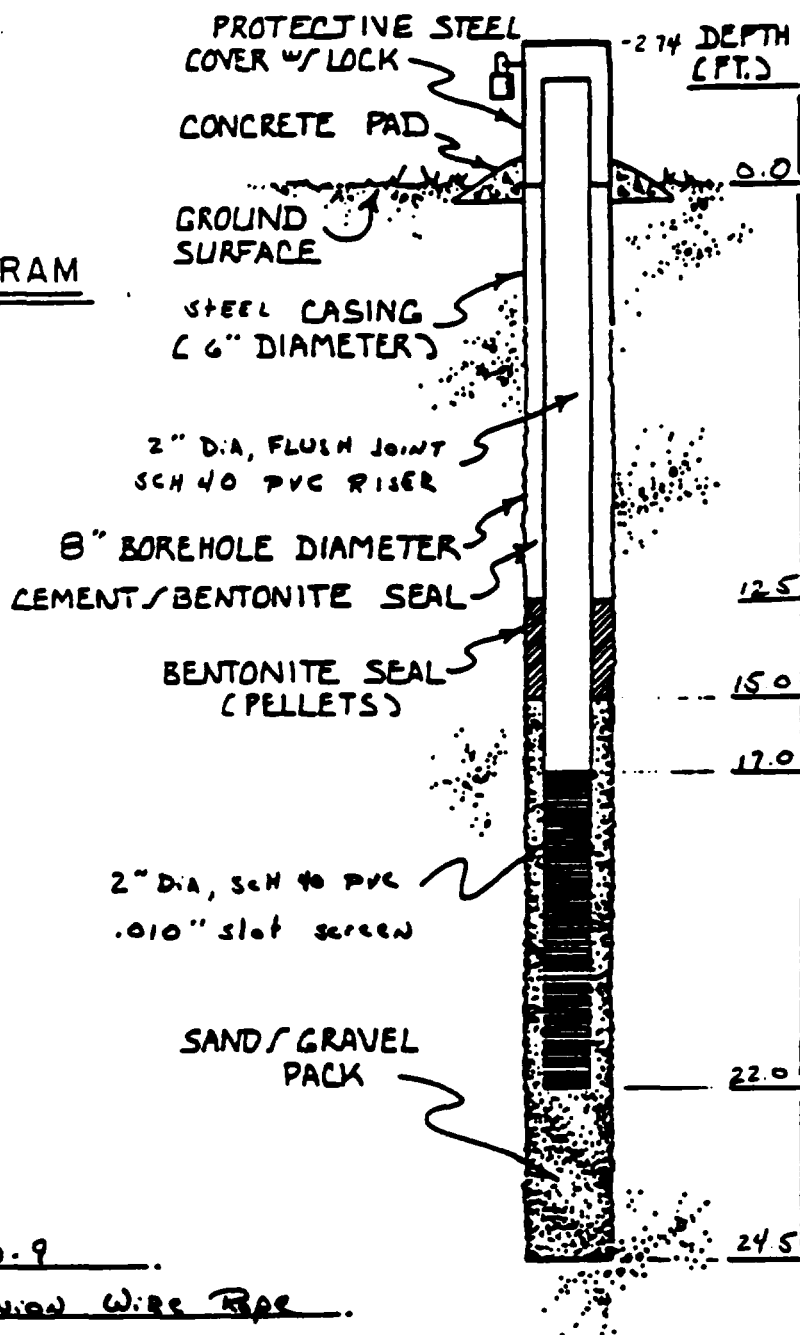


WELL CONSTRUCTION DIAGRAM

DRAWING NOT TO SCALE

NOTES:

Well located up gradient of
Building 35, shipping.



MONITORING WELL NO. MW-9

PROJECT NAME ARMCO Union Wire Rope

PROJECT NO. 88630

LOCATION South West corner of Building 35

GEOLOGIST D. Crowley

DRILLING CONTRACTOR Layne Western

DRILLER Buck Blank

DRILLING METHOD Hollow stem Auger

DRILLING DATE 11/17/88

GROUND ELEVATION 250.1

TOP ELEVATION 253.41

STATIC WATER DEPTH 7.0 (gs)

WATER ELEVATION 743.09

DATE 11/18/88

APPENDIX D
GROUND WATER MONITORING DATA

TABLE D-1

GROUND WATER MONITORING DATA
 SAMPLES COLLECTED BETWEEN JANUARY 1988 AND SEPTEMBER 1989
 GENERAL CHEMISTRY

MONITORING WELL MW-1								
PARAMETER	MW-001-01	MW-001-02	MW-001-04	MW-001-05	MW-001-06	MW-001-07	MW-001-08	MW-001-09
	JAN 08	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22
General Chemistry:								
pH	su	6.30// 6.30(1)	6.70	6.80	6.15	7.20	6.70	6.90
Alkalinity	mg/l CaCO ₃	350//350	NA(2)	NA	270	320	390	360
Specific Conductance	umhos/cm	1,600// 1,600	1,500	1,500	1,600	1,500	1,600	1,600
Nitrates	mg/l NO3-N	NA	0.1	0.5	0.4	0.2	0.2	0.2
Phenolics	mg/l	<0.01// 0.02	NA	0.02	0.01	0.01	<0.01	0.03
Total Lead	mg/l	0.12// 0.19	0.007/ 0.007	0.010	0.002	0.003	<0.001	0.012
Dissolved Lead	mg/l	-	-	-	-	-	-	<0.001

See footnotes at end of table.

TABLE D-1
(Continued)

MONITORING WELL MW-2								
PARAMETER	MW-002-01 JAN 08	MW-002-02 FEB 11	MW-002-04 APR 07	MW-002-05 AUG 28	MW-002-06 NOV 18	MW-002-07 JAN 25	MW-002-08 MAY 04	MW-002-09 SEP 22
General Chemistry:								
pH	6.30	6.30	6.60	6.00	7.20	6.40	6.15	7.25
Alkalinity mg/l CaCO ₃	240	NA	NA	490	320	200	220	190
Specific Conductance µmhos/cm	5,000	4,700	5,000	3,500	1,500	3,800	3,700	3,500
Nitrates mg/l NO3-N	NA	0.1	0.2	1.7	0.2	<0.1	<0.1	<0.1
Phenolics mg/l	NA	NA	0.02	0.01	0.01	<0.01	<0.01	0.04
Total Lead mg/l	0.035	0.011	<0.001	0.003	0.003	0.031	0.004	0.003
Dissolved Lead mg/l	-	-	-	-	-	-	-	<0.001

See footnotes at end of table.

TABLE D-1
(Continued)

PARAMETER	MONITORING WELL MW-3								
	MW-003-01 JAN 08	MW-003-02 FEB 11	MW-003-04 APR 07	MW-003-05 AUG 28	MW-003-06 NOV 18	MW-003-07 JAN 25	MW-003-08 MAY 04	MW-003-09 SEP 22	
General Chemistry:									
pH	7.10	6.60	7.20	6.50	7.70	6.70	6.50	7.60	
Alkalinity mg/l CaCO ₃	NA	NA	NA	240	270	270	270	340	
Specific Conductance µmhos/cm	900	800	800	900	800	900	850	850	
Nitrates mg/l NO3-N	NA	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	
Phenolics mg/l	<0.01	NA	0.04	<0.01	<0.01	<0.01	<0.01	0.06	
Total Lead mg/l	0.017	0.006	0.005	<0.002	0.008	0.020	0.017	0.004	
Dissolved Lead mg/l	-	-	-	-	-	-	-	<0.001	

See footnotes at end of table.

TABLE D-1
(Continued)

PARAMETER	MONITORING WELL MW-3A				
	MW-003A-06	MW-003A-07	MW-003A-08	MW-003A-09	
	NOV 18	JAN 25	MAY 04	SEP 22	
<u>General Chemistry:</u>					
pH	7.70	6.60	6.35	7.05	
Alkalinity mg/l CaCO ₃	140	180	140	120	
Specific Conductance umhos/cm	780	850	750	700	
Nitrates mg/l NO ₃ -N	<0.1	<0.1	<0.1	0.1	
Phenolics mg/l	<0.01	<0.01	<0.01	0.03	
Total Lead mg/l	0.005	0.009	<0.001	0.003	
Dissolved Lead mg/l	-	-	-	<0.001	

See footnotes at end of table.

TABLE D-1
(Continued)

MONITORING WELL MW-4

PARAMETER	JAN 08	FEB 11	MAR 31	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22
	MW-004-01	MW-004-02	MW-004-03	MW-004-04	MW-004-05	MW-004-06	MW-004-07	MW-004-08	MW-004-09
pH	6.60	6.40	NA	6.90	6.00	7.70	6.60	6.30	7.30
Alkalinity mg/l CaCO ₃	430	NA	NA	NA	320	450	360	390	420
Specific Conductance µmhos/cm	4,500	4,100	NA	3,000	4,600	3,200	4,600	3,200	2,800
Nitrates mg/l NO ₃ -N	<0.1	0.2	NA	0.2	0.1	<0.1	<0.1	<0.1	<0.1
Phenolics mg/l	NA	NA	NA	0.09	<0.01	<0.01	<0.01	<0.01	0.03
Total Lead mg/l	0.084	0.46	0.12/0.14	0.072	0.040	0.060	0.11	0.047	0.11
Dissolved Lead mg/l	-	-	-	-	-	-	-	-	0.012

See footnotes at end of table.

TABLE D-1
(Continued)

PARAMETER	MONITORING WELL MW-5							
	MW-005-01	MW-005-02	MW-005-04	MW-005-05	MW-005-06	MW-005-07	MW-005-08	MW-005-09
	JAN 08	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22
<u>General Chemistry:</u>								
pH	6.20	6.20	7.10	6.30	6.80	6.30	5.95	7.40
Alkalinity mg/l CaCO ₃	160	NA	NA	350	116	100	100	100
Specific Conductance µmhos/cm	2,500	1,400	1,800	1,500	1,500	1,500	1,500	1,600
Nitrates mg/l NO ₃ -N	NA	0.1	0.2	<0.1	0.4	0.1	<0.1	<0.1
Phenolics mg/l	NA	NA	0.10	0.02	0.37	<0.01	<0.01	0.08
Total Lead mg/l	0.008	0.063	0.010/ 0.010	0.023	0.008	0.020	0.004	0.004
Dissolved Lead mg/l	-	-	-	-	-	-	-	<0.001

See footnotes at end of table.

TABLE D-1
(Continued)

		MONITORING WELL MW-6							
		MW-006-01	MW-006-02	MW-006-04	MW-006-05	MW-006-06	MW-006-07	MW-006-08	MW-006-09
PARAMETER		JAN 08	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22
<u>General Chemistry:</u>									
pH	su	6.60	6.60	6.90// 7.00	6.35	7.80// 7.80	6.60// 6.50	6.10// 6.10	7.60// 7.60
Alkalinity	mg/l CaCO ₃	120	NA	NA	100	130//130	100//110	110//110	100//100
Specific Conductance	µmhos/cm	2,000	1,100	1,200// 1,200	1,000	1,000// 1,000	1,000// 1,000	1,000// 1,000	1,100// 1,000
Nitrates	mg/l NO ₃ -N	NA	<0.1	0.2//0.2	<0.1	0.1//<0.1	<0.1// <0.1	<0.1// <0.1	<0.1// <0.1
Phenolics	mg/l	<0.01	NA	0.17// 0.03	<0.01	<0.01// <0.01	<0.01// <0.01	<0.01// <0.01	0.05// 0.08
Total Lead	mg/l	0.008	0.018	0.009// 0.005	0.044	0.012// 0.021	0.026// 0.036	0.009// 0.042	0.008// 0.010
Dissolved Lead	mg/l	-	-	-	-	-	-	-	<0.001// <0.001

See footnotes at end of table.

TABLE D-1
(Continued)

		MONITORING WELL MW-7							
		MW-007-01	MW-007-02	MW-007-04	MW-007-05	MW-007-06	MW-007-07	MW-007-08	MW-007-09
PARAMETER		JAN 08	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22
<u>General Chemistry:</u>									
pH	su	6.30	6.70	7.00	6.30	7.70	6.70	6.15	7.25
Alkalinity	mg/l CaCO ₃	120	NA	NA	78	72	56	72	72
Specific Conductance	µmhos/cm	2,500	2,500	1,200	1,100	1,100	1,100	1,000	1,000
Nitrates	mg/l NO ₃ -N	NA	NA	0.2	0.4	0.3	0.3	1.8	0.4
Phenolics	mg/l	NA	NA	0.03	<0.01	0.01	0.02	<0.01	0.11
Total Lead	mg/l	0.026	0.26	0.005	0.005	0.004	0.019	0.003	0.004
Dissolved Lead	mg/l	-	-	-	-	-	-	-	<0.001

See footnotes at end of table.

TABLE D-1
(Continued)

MONITORING WELL MW-8								
PARAMETER	MW-008-01	MW-008-02	MW-008-04	MW-008-05	MW-008-06	MW-008-07	MW-008-08	MW-008-09
	JAN 08	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22
<u>General Chemistry:</u>								
pH	6.90	7.10	7.40	6.70// 6.65	7.70	7.20	6.75	7.30
Alkalinity mg/l CaCO ₃	410	NA	NA	380//380	260	320	400	370
Specific Conductance µmhos/cm	1,000	800	1,000	900//800	580	900	900	750
Nitrates mg/l NO3-N	NA	<0.1	0.3	<0.1// <0.1	1.1	<0.1	<0.1	<0.1
Phenolics mg/l	NA	NA	0.02	<0.01// 0.01	<0.01	<0.01	<0.01	0.05
Total Lead mg/l	0.008	0.001	0.003	<0.001// 0.001	<0.001	0.004	0.003	0.005
Dissolved Lead mg/l	-	-	-	-	-	-	-	<0.001

See footnotes at end of table.

TABLE D-1
(Continued)

PARAMETER	MONITORING WELL MW-9			
	MW-009-06 NOV 18	MW-009-07 JAN 25	MW-009-08 MAY 04	MW-009-09 SEP 22
<u>General Chemistry:</u>				
pH	7.70	6.50	6.00	7.05
Alkalinity su mg/l CaCO ₃	90	60	64	61
Specific Conductance µmhos/cm	600	600	500	550
Nitrates mg/l NO ₃ -N	<0.1	<0.1	3.9	<0.1
Phenolics mg/l	<0.01	<0.01	<0.01	0.08
Total Lead mg/l	0.019	0.021	0.003	0.021
Dissolved Lead mg/l	-	-	-	<0.001

See footnotes at end of table.

TABLE D-1
(Continued)

PARAMETER	FIELD BLANKS										TRIP BLANKS	
	MW-000-01	MW-000-02	MW-000-03	MW-000-04	MW-000-05	MW-000-06	MW-000-07	MW-000-08	MW-000-09			
	JAN 08	FEB 11	MAR 31	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22			NOV 18/88
<u>General Chemistry:</u>												
pH	4.60	7.10	NA	5.20	5.15	8.40	7.00	6.20	4.85			4.30
Alkalinity mg/l CaCO_3	<1	NA	NA	NA	4	2	2	2	6			<2
Specific Conductance umhos/cm	80	9	NA	2	30	5	2	2	3			2.6
Nitrates mg/l $\text{NO}_3\text{-N}$	NA	<0.1	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
Phenolics mg/l	<0.01	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			<0.01
Total Lead mg/l	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.003			<0.001
Dissolved Lead mg/l	-	-	-	-	-	-	-	-	<0.001			-

(1)"#/#" indicates replicate sample collected and analyzed.

(2)"NA" indicates not analyzed.

(3)"<" indicates less than method detection limits.

(4)Elevated detection limit due to small sample volume.

TABLE D-2

GROUND WATER MONITORING DATA
 SAMPLES COLLECTED BETWEEN JANUARY 1988 AND SEPTEMBER 1989
 PRIORITY POLLUTANT LIST VOLATILE ORGANICS

PARAMETER	MONITORING WELL MW-1									
	MW-001-01	MW-001-02	MW-001-04	MW-001-05	MW-001-06	MW-001-07	MW-001-08	MW-001-09		
	JAN 08	FEB 11	APR 07 (1)	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22		
Acrolein	<250//<250(2,3)	<250	<250	<250	<250	<250	<250	<250		<250
Acrylonitrile	<250//<250	<250	<250	<250	<250	<250	<250	<250		<250
Benzene	<5//<5	<5	9	<5	<5	<5	<5	<5		<5
Carbon Tetrachloride	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Chlorobenzene	<5//<5	<5	<5	<5	<5	<5	8	<5		<5
1,2-Dichloroethane	<5//<5	<5	6	<5	<5	<5	<5	<5		<5
1,1,1-Trichloroethane	820//610	170	210	100	74	130	95	87		<5
1,1-Dichloroethane	<5//<5	630	480	250	340	330	170	300		<5
1,1,2-Trichloroethane	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
1,1,2,2-Tetrachloroethane	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Chloroethane	<5//<5	770	<5	770	430	230	470	770		<5
2-Chloroethylvinyl Ether	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Chloroform	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
1,1-Dichloroethylene	200//130	70	77	58	64	28	47	18		<5
Trans-1,2-Dichloroethylene	<5//<5	<5	<5	11	<5	250	<5	<5		<5
1,2-Dichloropropane	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Cis-1,3-Dichloropropylene	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Ethylbenzene	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Methylene Chloride	<5//<5	<5	<5	<5	<5	<5	20	<5		<5
Methyl Chloride	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Methyl Bromide	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Bromoform	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Dichlorobromomethane	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Chlorodibromomethane	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Tetrachloroethylene	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Toluene	<5//<5	<5	<5	<5	<5	<5	<5	<5		<5
Trichloroethylene	<5//<5	<5	9	<5	<5	<5	<5	<5		<5
Vinyl Chloride	<5//<5	24	11	<5	<5	180	530	<5		<5

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	MONITORING WELL MW-2									
	MW-002-02	MW-002-04	MW-002-05	MW-002-06	MW-002-07	MW-002-08	MW-002-09			
	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22			
Acrolein	<50	<250	<250	<250	<250	<250	<250			
Acrylonitrile	<50	<250	<250	<250	<250	<250	<250			
Benzene	<5	<5	<5	<5	<5	<5	<5			
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	<5			
Chlorobenzene	<5	<5	<5	<5	<5	<5	<5			
1,2-Dichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,1-Trichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1-Dichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,2-Trichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	<5	<5	<5			
Chloroethane	<5	<5	<5	<5	<5	<5	<5			
2-Chloroethylvinyl Ether	<5	<5	<5	<5	<5	<5	<5			
Chloroform	<5	<5	<5	<5	<5	<5	<5			
1,1-Dichloroethylene	<5	<5	<5	<5	<5	<5	<5			
Trans-1,2-Dichloroethylene	<5	<5	<5	<5	<5	<5	<5			
1,2-Dichloropropane	<5	<5	<5	<5	<5	<5	<5			
Cis-1,3-Dichloropropylene	<5	<5	<5	<5	<5	<5	<5			
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5			
Methylene Chloride	<5	<5	<5	<5	<5	<5	<5			
Methyl Chloride	<5	<5	<5	<5	<5	<5	<5			
Methyl Bromide	<5	<5	<5	<5	<5	<5	<5			
Bromoform	<5	<5	<5	<5	<5	<5	<5			
Dichlorobromomethane	<5	<5	<5	<5	<5	<5	<5			
Chlorodibromomethane	<5	<5	<5	<5	<5	<5	<5			
Tetrachloroethylene	<5	<5	<5	<5	<5	<5	<5			
Toluene	<5	<5	<5	<5	<5	<5	<5			
Trichloroethylene	<5	<5	<5	<5	<5	<5	<5			
Vinyl Chloride	<5	<5	<5	<5	<5	<5	<5			

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	MONITORING WELL MW-3									
	MW-003-01	MW-003-02	MW-003-04	MW-003-05	MW-003-06	MW-003-07	MW-003-08	MW-003-09		
	JAN 08	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22		
Acrolein	<250	<250	<250	<250	<250	<250	<250	<250		
Acrylonitrile	<250	<250	<250	<250	<250	<250	<250	<250		
Benzene	<5	9	<5	<5	<5	<5	<5	<5		
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	<5	<5		
Chlorobenzene	<5	<5	<5	<5	<5	<5	<5	<5		
1,2-Dichloroethane	<5	6	<5	<5	<5	<5	<5	<5		
1,1,1-Trichloroethane	250	210	64	150	97	430	420	84		
1,1-Dichloroethane	<5	82	53	13	35	69	140	60		
1,1,2-Trichloroethane	<5	<5	<5	<5	<5	<5	<5	<5		
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	<5	<5	<5	<5		
Chloroethane	<5	<5	<5	<5	<5	<5	<5	<5		
2-Chloroethylvinyl Ether	<5	<5	<5	<5	<5	<5	<5	<5		
Chloroform	<5	<5	<5	<5	<5	<5	<5	<5		
1,1-Dichloroethylene	380	490	250	<5	350	930	3,400	63		
Trans-1,2-Dichloroethylene	<5	<5	11	<5	18	67	<5	<5		
1,2-Dichloropropane	<5	<5	<5	<5	<5	<5	<5	<5		
Cis-1,3-Dichloropropylene	<5	<5	<5	<5	<5	<5	<5	<5		
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5	<5		
Methylene Chloride	<5	<5	<5	<5	<5	<5	<5	<5		
Methyl Chloride	<5	<5	<5	<5	<5	<5	<5	<5		
Methyl Bromide	<5	<5	<5	<5	<5	<5	<5	<5		
Bromoform	<5	<5	<5	<5	<5	<5	<5	<5		
Dichlorobromomethane	<5	<5	<5	<5	<5	<5	<5	<5		
Chlorodibromomethane	<5	<5	<5	<5	<5	<5	<5	<5		
Tetrachloroethylene	<5	10	<5	10	10	13	21	6		
Toluene	<5	<5	<5	<5	<5	<5	<5	<5		
Trichloroethylene	<5	10	<5	11	9	9	<5	<5		
Vinyl Chloride	<5	<5	<5	<5	<5	<5	100	5		

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	MONITORING WELL MW-3A				
	MW-003A-06	MW-003A-07	MW-003A-08	MW-003A-09	
	NOV 18	JAN 25	MAY 04	SEP 22	
Acrolein	<250	<250	<250	<250	<250
Acrylonitrile	<250	<250	<250	<250	<250
Benzene	<5	<5	<5	<5	<5
Carbon Tetrachloride	<5	<5	9	<5	<5
Chlorobenzene	<5	<5	<5	<5	<5
1,2-Dichloroethane	<5	<5	<5	<5	<5
1,1,1-Trichloroethane	41	45	97	48	48
1,1-Dichloroethane	13	10	15	7	7
1,1,2-Trichloroethane	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	<5
Chloroethane	<5	<5	<5	<5	<5
2-Chloroethylvinyl Ether	<5	<5	<5	<5	<5
Chloroform	<5	<5	<5	<5	<5
1,1-Dichloroethylene	290	130	230	26	26
Trans-1,2-Dichloroethylene	<5	<5	<5	<5	<5
1,2-Dichloropropane	<5	<5	<5	<5	<5
Cis-1,3-Dichloropropylene	<5	<5	<5	<5	<5
Ethylbenzene	<5	<5	<5	<5	<5
Methylene Chloride	<5	<5	<5	<5	<5
Methyl Chloride	<5	<5	19	<5	<5
Methyl Bromide	<5	<5	<5	<5	<5
Bromoform	<5	<5	<5	<5	<5
Dichlorobromomethane	<5	<5	<5	<5	<5
Chlorodibromomethane	<5	<5	<5	<5	<5
Tetrachloroethylene	17	14	<5	30	30
Toluene	<5	<5	<5	5	5
Trichloroethylene	<5	<5	<5	<5	<5
Vinyl Chloride	<5	<5	<5	<5	<5

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	MONITORING WELL MW-4									
	MW-004-02	MW-004-04	MW-004-05	MW-004-06	MW-004-07	MW-004-08	MW-004-09			
	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22			
Acrolein	<250	<250	<250	<250	<250	<250	<250			
Acrylonitrile	<250	<250	<250	<250	<250	<250	<250			
Benzene	<5	<5	<5	<5	<5	<5	<5			
Carbon Tetrachloride	<5	<5	<5	<5	<5	5	<5			
Chlorobenzene	<5	<5	<5	<5	<5	<5	<5			
1,2-Dichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,1-Trichloroethane	58	33	32	26	47	54	23			
1,1-Dichloroethane	8	6	24	8	170	9	<5			
1,1,2-Trichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	<5	<5	<5			
Chloroethane	<5	<5	<5	<5	<5	<5	<5			
2-Chloroethylvinyl Ether	<5	<5	<5	<5	<5	<5	<5			
Chloroform	<5	<5	<5	<5	<5	<5	<5			
1,1-Dichloroethylene	48	43	28	48	35	64	14			
Trans-1,2-Dichloroethylene	<5	<5	<5	<5	<5	<5	<5			
1,2-Dichloropropane	<5	<5	<5	<5	<5	<5	<5			
Cis-1,3-Dichloropropylene	<5	<5	<5	<5	<5	<5	<5			
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5			
Methylene Chloride	<5	<5	14	<5	<5	21	<5			
Methyl Chloride	<5	<5	<5	<5	<5	<5	<5			
Methyl Bromide	<5	<5	<5	<5	<5	<5	<5			
Bromoform	<5	<5	<5	<5	<5	<5	<5			
Dichlorobromomethane	<5	<5	<5	<5	<5	<5	<5			
Chlorodibromomethane	<5	<5	<5	<5	<5	<5	<5			
Tetrachloroethylene	<5	<5	<5	<5	<5	<5	<5			
Toluene	<5	<5	<5	<5	<5	<5	<5			
Trichloroethylene	<5	<5	<5	<5	<5	<5	<5			
Vinyl Chloride	<5	<5	<5	<5	<5	<5	<5			

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	MONITORING WELL MW-5							
	MW-005-02	MW-005-05	MW-005-06	MW-005-07	MW-005-08	MW-005-09		
	FEB 11	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22		
Acrolein	<250	<250	<250	<250	<250	<250	ug/l	
Acrylonitrile	<250	<250	<250	<250	<250	<250	ug/l	
Benzene	<5	<5	<5	<5	<5	<5	ug/l	
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	ug/l	
Chlorobenzene	<5	<5	<5	<5	<5	<5	ug/l	
1,2-Dichloroethane	<5	<5	<5	<5	<5	<5	ug/l	
1,1,1-Trichloroethane	<5	<5	<5	<5	<5	<5	ug/l	
1,1-Dichloroethane	<5	<5	<5	<5	<5	<5	ug/l	
1,1,2-Trichloroethane	<5	<5	<5	<5	<5	<5	ug/l	
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	<5	<5	ug/l	
Chloroethane	<5	<5	<5	<5	<5	<5	ug/l	
2-Chloroethylvinyl Ether	<5	<5	<5	<5	<5	<5	ug/l	
Chloroform	<5	<5	<5	<5	<5	<5	ug/l	
1,1-Dichloroethylene	<5	<5	<5	<5	<5	<5	ug/l	
Trans-1,2-Dichloroethylene	<5	<5	<5	<5	<5	<5	ug/l	
1,2-Dichloropropane	<5	<5	<5	<5	<5	<5	ug/l	
Cis-1,3-Dichloropropylene	<5	<5	<5	<5	<5	<5	ug/l	
Ethylbenzene	<5	<5	<5	<5	<5	<5	ug/l	
Methylene Chloride	<5	<5	<5	<5	<5	<5	ug/l	
Methyl Chloride	<5	<5	<5	<5	<5	<5	ug/l	
Methyl Bromide	<5	<5	<5	<5	<5	<5	ug/l	
Bromoform	<5	<5	<5	<5	<5	<5	ug/l	
Dichlorobromomethane	<5	<5	<5	<5	<5	<5	ug/l	
Chlorodibromomethane	<5	<5	<5	<5	<5	<5	ug/l	
Tetrachloroethylene	<5	<5	<5	<5	<5	<5	ug/l	
Toluene	<5	<5	<5	<5	<5	<5	ug/l	
Trichloroethylene	<5	<5	<5	<5	<5	<5	ug/l	
Vinyl Chloride	<5	<5	<5	<5	<5	<5	ug/l	

See footnotes at end of table.

TABLE D-2
(Continued)

MONITORING WELL MW-6									
PARAMETER	MW-006-01	MW-006-04	MW-006-05	MW-006-06	MW-006-07	MW-006-08	MW-006-09		
	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22		
Acrolein	ug/l	<250	<250	<250	<250	<250	<250	<250	<250
Acrylonitrile	ug/l	<250	<250	<250	<250	<250	<250	<250	<250
Benzene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
1,1,1-Trichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Chloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
2-Chloroethylvinyl Ether	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Trans-1,2-Dichloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloropropane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Cis-1,3-Dichloropropylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Methylene Chloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Chloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Bromide	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Dichlorobromomethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Chlorodibromomethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Toluene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5
Vinyl Chloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	MONITORING WELL MW-7									
	MW-007-02	MW-007-04	MW-007-05	MW-007-06	MW-007-07	MW-007-08	MW-007-09			
	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22			
Acrolein	ug/l									
Acrylonitrile	<250	<250	<250	<250	<250	<250	<250			
Benzene	<5	<5	<5	<5	<5	<5	<5			
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	<5			
Chlorobenzene	<5	<5	<5	<5	<5	<5	<5			
1,2-Dichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,1-Trichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1-Dichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,2-Trichloroethane	<5	<5	<5	<5	<5	<5	<5			
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	<5	<5	<5			
Chloroethane	<5	<5	<5	<5	<5	<5	<5			
2-Chloroethylvinyl Ether	<5	<5	<5	<5	<5	<5	<5			
Chloroform	<5	<5	<5	<5	<5	<5	<5			
1,1-Dichloroethylene	<5	<5	<5	<5	<5	<5	<5			
Trans-1,2-Dichloroethylene	<5	<5	<5	<5	<5	<5	<5			
1,2-Dichloropropane	<5	<5	<5	<5	<5	<5	<5			
Cis-1,3-Dichloropropylene	<5	<5	<5	<5	<5	<5	<5			
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5			
Methylene Chloride	<5	<5	<5	<5	<5	<5	<5			
Methyl Chloride	<5	<5	<5	<5	<5	<5	<5			
Methyl Bromide	<5	<5	<5	<5	<5	<5	<5			
Bromoform	<5	<5	<5	<5	<5	<5	<5			
Dichlorobromomethane	<5	<5	<5	<5	<5	<5	<5			
Chlorodibromomethane	<5	<5	<5	<5	<5	<5	<5			
Tetrachloroethylene	<5	<5	<5	<5	<5	<5	<5			
Toluene	<5	<5	<5	<5	<5	<5	<5			
Trichloroethylene	<5	<5	<5	<5	<5	<5	<5			
Vinyl Chloride	<5	<5	<5	<5	<5	<5	<5			

See footnotes at end of table.

TABLE D-2
(Continued)

MONITORING WELL MW-8									
PARAMETER	MW-008-02	MW-008-04	MW-008-05	MW-008-06	MW-008-07	MW-008-08	MW-008-09		
	FEB 11	APR 07	AUG 28	NOV 18	JAN 25	MAY 04	SEP 22		
Acrolein	<50	<250	<250//<250	<250	<250	<250	<250		<250
Acrylonitrile	<250	<250	<250//<250	<250	<250	<250	<250		<250
Benzene	<5	<5	<5//<5	<5	<5	<5	<5		<5
Carbon Tetrachloride	<5	<5	<5//<5	<5	<5	<5	<5		<5
Chlorobenzene	<5	<5	<5//<5	<5	<5	<5	<5		<5
1,2-Dichloroethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
1,1,1-Trichloroethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
1,1-Dichloroethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
1,1,2-Trichloroethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
1,1,2,2-Tetrachloroethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
Chloroethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
2-Chloroethylvinyl Ether	<5	<5	<5//<5	<5	<5	<5	<5		<5
Chloroform	<5	<5	<5//<5	<5	<5	<5	<5		<5
1,1-Dichloroethylene	<5	<5	<5//<5	<5	<5	<5	<5		<5
Trans-1,2-Dichloroethylene	<5	<5	<5//<5	<5	<5	<5	<5		<5
1,2-Dichloropropane	<5	<5	<5//<5	<5	<5	<5	<5		<5
Cis-1,3-Dichloropropylene	<5	<5	<5//<5	<5	<5	<5	<5		<5
Ethylbenzene	<5	<5	<5//<5	<5	<5	<5	<5		<5
Methylene Chloride	<5	<5	<5//<5	<5	<5	<5	<5		<5
Methyl Chloride	<5	<5	<5//<5	<5	<5	<5	<5		<5
Methyl Bromide	<5	<5	<5//<5	<5	<5	<5	<5		<5
Bromoform	<5	<5	<5//<5	<5	<5	<5	<5		<5
Dichlorobromomethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
Chlorodibromomethane	<5	<5	<5//<5	<5	<5	<5	<5		<5
Tetrachloroethylene	<5	<5	<5//<5	<5	<5	<5	<5		<5
Toluene	<5	<5	<5//<5	<5	<5	<5	<5		<5
Trichloroethylene	<5	<5	<5//<5	<5	<5	<5	<5		<5
Vinyl Chloride	<5	<5	<5//<5	<5	<5	<5	<5		<5

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	MONITORING WELL MM-3A				
	MM-009-06	MM-009-07	MM-009-08	MM-009-09	
	NOV 18	JAN 25	MAY 04	SEP 22	
Acrolein	<250	<250	<250	<250	ug/l
Acrylonitrile	<250	<250	<250	<250	ug/l
Benzene	<5	<5	<5	<5	ug/l
Carbon Tetrachloride	<5	<5	<5	<5	ug/l
Chlorobenzene	<5	<5	<5	<5	ug/l
1,2-Dichloroethane	<5	<5	<5	<5	ug/l
1,1,1-Trichloroethane	<5	<5	<5	<5	ug/l
1,1-Dichloroethane	<5	<5	<5	<5	ug/l
1,1,2-Trichloroethane	<5	<5	<5	<5	ug/l
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	ug/l
Chloroethane	<5	<5	<5	<5	ug/l
2-Chloroethylvinyl Ether	<5	<5	<5	<5	ug/l
Chloroform	<5	<5	<5	<5	ug/l
1,1-Dichloroethylene	<5	<5	<5	<5	ug/l
Trans-1,2-Dichloroethylene	<5	<5	<5	<5	ug/l
1,2-Dichloropropane	<5	<5	<5	<5	ug/l
Cis-1,3-Dichloropropylene	<5	<5	<5	<5	ug/l
Ethylbenzene	<5	<5	<5	<5	ug/l
Methylene Chloride	<5	<5	<5	<5	ug/l
Methyl Chloride	<5	<5	<5	<5	ug/l
Methyl Bromide	<5	<5	<5	<5	ug/l
Bromoform	<5	<5	<5	<5	ug/l
Dichlorobromomethane	<5	<5	<5	<5	ug/l
Chlorodibromomethane	<5	<5	<5	<5	ug/l
Tetrachloroethylene	<5	<5	<5	<5	ug/l
Toluene	<5	<5	<5	<5	ug/l
Trichloroethylene	<5	9	23	14	ug/l
Vinyl Chloride	<5	<5	<5	<5	ug/l

See footnotes at end of table.

TABLE D-2
(Continued)

PARAMETER	FIELD BLANKS										TRIP BLANK	
	MW-000-01	MW-000-02	MW-000-04	MW-000-05	MW-000-06	MW-000-07	MW-000-08	MW-000-09	SEP 22	NOV 18	NOV 18	NOV 18
Acrolein	ug/l	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250
Acrylonitrile	ug/l	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250
Benzene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,1-Trichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
2-Chloroethylvinyl Ether	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trans-1,2-Dichloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloropropane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cis-1,3-Dichloropropylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methylene Chloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Chloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Bromide	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dichlorobromomethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorodibromomethane	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Toluene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethylene	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vinyl Chloride	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

(1) Sample was held at 4°C for 35 days prior to analysis.

(2) "g//g" indicates replicate sample collected and analyzed.

(3) "<" indicates less than method detection limit.

TABLE D-3
GROUND WATER MONITORING DATA
ADDITIONAL METALS ANALYSES
SAMPLES COLLECTED - JANUARY 8, 1988

METAL (1)	UNITS	WELL MW-1	WELL MW-2	WELL MW-3	WELL MW-4	WELL MW-5	WELL MW-6	WELL MW-7	WELL MW-8	FIELD BLANK
		MW-001-01	MW-002-01	MW-003-01	MW-004-01	MW-005-01	MW-006-01	MW-007-01	MW-008-01	MW-000-01
Metals:										
Arsenic	mg/l (2)	0.014//0.014 (3)		0.003					0.001	<0.001 (4)
Barium	mg/l	0.50//0.55		0.55					<0.01	<0.01
Beryllium	mg/l	<0.01//<0.01		<0.01					<0.01	<0.01
Cadmium	mg/l	<0.01//<0.01		<0.01					<0.01	<0.01
Chromium	mg/l	<0.01//0.02		0.01					<0.01	<0.01
Copper	mg/l	0.09//0.09	0.10	0.04	0.08	0.10	0.10	0.04	<0.01	<0.01
Mercury	mg/l	<0.0005//<0.0005		<0.0005					<0.0005	<0.0005
Nickel	mg/l	<0.1//0.1		0.1					<0.1	<0.1
Selenium	mg/l	<0.001//<0.001		<0.001					<0.001	<0.001
Silver	mg/l	0.01//0.02		<0.01					<0.01	<0.01
Zinc	mg/l	0.26//0.26	0.17	0.07	11	0.11	0.20	0.09	0.03	<0.01

(1) Lead analyses are included in Table D-1 since they are run routinely.

(2) "mg/l" indicates milligrams per liter or parts per million.

(3) "#//#" indicates collection and analysis of replicate samples.

(4) "<" indicates less than method detection limit.

TABLE D-4
GROUND WATER MONITORING DATA
SAMPLES COLLECTED BETWEEN JANUARY 1988 AND JANUARY 1989
ACID EXTRACTABLE SEMI-VOLATILE COMPOUNDS

PARAMETER		MW-007-01	MW-007-06
		JANUARY 08	NOVEMBER 18
2-Chlorophenol	µg/l ⁽¹⁾	NA ⁽²⁾	<10 ⁽³⁾
2,4-Dichlorophenol	µg/l	NA	<10
2,4-Dimethylphenol	µg/l	NA	<10
4,6-Dinitro-o-cresol	µg/l	NA	<50
2,4-Dinitrophenol	µg/l	NA	<10
2-Nitrophenol	µg/l	NA	<50
4-Nitrophenol	µg/l	NA	<50
P-Chloro-m-cresol	µg/l	NA	<10
Pentachlorophenol	µg/l	<85	<50
Phenol	µg/l	NA	<10
2,4,6-Trichlorophenol	µg/l	NA	<10

(1)"µg/l" indicates micrograms per liter or parts per billion.

(2)"NA" indicates not analyzed.

(3)"<" indicates less than method detection limit.

TABLE D-5

STATISTICAL SUMMARY
GROUND WATER MONITORING DATA
INORGANIC CHEMISTRY AND PHENOLICS
JANUARY 1988 THROUGH SEPTEMBER 1989

WELL NUMBER	PARAMETER	UNITS	DATA POINTS	MEAN	MEDIAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
MW-1	pH	su	8	6.68	6.70	0.33	6.15	7.20
	Specific conductance	umho/cm	8	1,600	1,600	131	1,500	1,900
	Alkalinity	mg/l	6	337	340	41	270	390
	Nitrates	mg/l	7	0.24	0.2	0.16	< 0.1	0.50
	Phenolics	mg/l	7	0.013	0.01	0.009	< 0.01	0.03
	Lead (total)	mg/l	8	0.027	0.0085	0.052	< 0.001	0.19
MW-2	pH	su	8	6.53	6.35	0.45	6.00	7.50
	Specific conductance	umho/cm	8	3,840	3,750	1,140	1,500	5,000
	Alkalinity	mg/l	6	277	230	114	190	490
	Nitrates	mg/l	7	0.34	0.1	0.61	< 0.1	1.7
	Phenolics	mg/l	6	0.015	0.01	0.013	< 0.01	0.040
	Lead (total)	mg/l	8	0.011	0.0040	0.014	< 0.001	0.035
MW-3	pH	su	8	6.90	6.90	0.49	6.50	7.70
	Specific conductance	umho/cm	8	850	850	46	800	900
	Alkalinity	mg/l	5	298	270	54	240	340
	Nitrates	mg/l	7	0.07	< 0.1	0.06	< 0.1	0.2
	Phenolics	mg/l	7	0.018	< 0.01	0.023	< 0.01	0.06
	Lead (total)	mg/l	8	0.010	0.007	0.0072	< 0.002	0.020
MW-3A	pH	su	4	6.93	6.83	0.59	6.35	7.70
	Specific conductance	umho/cm	4	770	765	63	700	850
	Alkalinity	mg/l	4	145	140	25	120	180
	Nitrates	mg/l	4	0.06	< 0.1	0.025	< 0.1	< 0.1
	Phenolics	mg/l	4	0.01	< 0.01	0.013	< 0.01	0.03
	Lead (total)	mg/l	4	0.0040	0.004	0.0041	< 0.001	0.009
MW-4	pH	su	8	6.73	6.60	0.55	6.00	7.70
	Specific conductance	umho/cm	8	3,750	3,650	775	2,800	4,600
	Alkalinity	mg/l	6	395	405	48	320	450
	Nitrates	mg/l	8	0.094	< 0.1	0.068	< 0.1	0.2
	Phenolics	mg/l	6	0.023	< 0.01	0.034	< 0.01	0.09
	Lead (total)	mg/l	9	0.12	0.084	0.13	0.040	0.46

TABLE D-5

(CONTINUED)

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WELL NUMBER	PARAMETER	UNITS	DATA POINTS	MEAN	MEDIAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
MW-5	pH	su	8	6.53	6.25	0.51	5.95	7.40
	Specific conductance	umho/cm	8	1,660	1,500	358	1,400	2,500
	Alkalinity	mg/l	6	153	105	99	100	350
	Nitrates	mg/l	7	0.14	0.10	0.13	< 0.1	0.4
	Phenolics	mg/l	6	0.097	0.05	0.15	< 0.01	0.37
	Lead (total)	mg/l	8	0.018	0.009	0.020	0.004	0.063
MW-6	pH	su	8	6.82	6.60	0.60	6.10	7.80
	Specific conductance	umho/cm	8	1,170	1,030	343	1,000	2,000
	Alkalinity	mg/l	6	111	108	12	100	130
	Nitrates	mg/l	7	0.075	< 0.1	0.06	< 0.1	0.2
	Phenolics	mg/l	7	0.027	< 0.01	0.039	< 0.01	0.17
	Lead (total)	mg/l	8	0.020	0.017	0.013	0.005	0.044
MW-7	pH	su	8	6.76	6.70	0.53	6.15	7.70
	Specific conductance	umho/cm	8	1,440	1,100	659	1,000	2,500
	Alkalinity	mg/l	6	78	72	22	60	120
	Nitrates	mg/l	6	0.57	0.35	0.61	0.20	1.8
	Phenolics	mg/l	6	0.030	0.015	0.040	< 0.01	0.11
	Lead (total)	mg/l	8	0.041	0.005	0.089	0.003	0.26
MW-8	pH	su	8	7.13	7.15	0.35	6.65	7.70
	Specific conductance	umho/cm	8	848	880	139	580	1,000
	Alkalinity	mg/l	6	357	380	57	260	410
	Nitrates	mg/l	7	0.24	< 0.1	0.39	< 0.1	1.1
	Phenolics	mg/l	6	0.015	< 0.01	0.018	< 0.01	0.05
	Lead (total)	mg/l	8	0.0032	0.003	0.0025	< 0.001	0.008
MW-9	pH	su	4	6.81	6.50	0.73	6.00	7.70
	Specific conductance	umho/cm	4	563	580	48	500	600
	Alkalinity	mg/l	4	69	61	14	60	90
	Nitrates	mg/l	4	1.03	0.075	1.92	< 0.1	3.9
	Phenolics	mg/l	4	0.006	< 0.01	0.002	< 0.01	0.08
	Lead (total)	mg/l	4	0.016	0.020	0.0087	0.003	0.021

TABLE D-6

STATISTICAL SUMMARY
GROUND WATER MONITORING DATA
VOLATILE ORGANIC COMPOUNDS
JANUARY 1988 THROUGH SEPTEMBER 1989

WELL NUMBER	PARAMETER (1)	NUMBER OF SAMPLES	TIMES DETECTED	FREQUENCY DETECTED (percent)	CONCENTRATIONS (ug/l) MEDIAN	MAXIMUM
MW-1	Benzene	8	1	12.5%	< 5	9
	Chloroethane	8	6	75.0%	450	770
	1,1-dichloroethane	8	7	87.5%	320	630
	1,2-dichloroethane	8	1	12.5%	< 5	6
	1,1,1-trichloroethane	8	8	100.0%	115	820
	1,1-dichloroethylene	8	8	100.0%	61	200
	1,2-trans-dichloroethylene	8	2	25.0%	< 5	250
	Trichloroethylene	8	0	0.0%	< 5	< 5
	Tetrachloroethylene	8	0	0.0%	< 5	< 5
	Vinyl chloride	8	4	50.0%	7	530
MW-2	None detected	7	0	0.0%	—	—
MW-3	Benzene	8	1	12.5%	< 5	9
	Chloroethane	8	0	0.0%	< 5	< 5
	1,1-dichloroethane	8	7	87.5%	57	140
	1,2-dichloroethane	8	1	12.5%	< 5	6
	1,1,1-trichloroethane	8	8	100.0%	180	430
	1,1-dichloroethylene	8	7	87.5%	365	3,400
	1,2-trans-dichloroethylene	8	3	37.5%	< 5	67
	Trichloroethylene	8	4	50.0%	6	11
	Tetrachloroethylene	8	6	75.0%	10	21
	Vinyl chloride	8	2	25.0%	< 5	100
MW-3A	Benzene	4	0	0.0%	< 5	< 5
	Chloroethane	4	0	0.0%	< 5	< 5
	1,1-dichloroethane	4	4	100.0%	12	15
	1,2-dichloroethane	4	0	0.0%	< 5	< 5
	1,1,1-trichloroethane	4	4	100.0%	47	97
	1,1-dichloroethylene	4	4	100.0%	180	290
	1,2-trans-dichloroethylene	4	0	0.0%	< 5	< 5
	Trichloroethylene	4	0	0.0%	< 5	< 5
	Tetrachloroethylene	4	3	75.0%	16	30
	Vinyl chloride	4	0	0.0%	< 5	< 5

See footnote at end of table.

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(CONTINUED)

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WELL NUMBER	PARAMETER (1)	NUMBER OF SAMPLES	TIMES DETECTED	FREQUENCY DETECTED (percent)	CONCENTRATIONS (ug/l)	
					MEDIAN	MAXIMUM
MW-4	Benzene	7	0	0.0%	< 5	< 5
	Chloroethane	7	0	0.0%	< 5	< 5
	1,1-dichloroethane	7	6	85.7%	8	170
	1,2-dichloroethane	7	0	0.0%	< 5	< 5
	1,1,1-trichloroethane	7	7	100.0%	33	58
	1,1-dichloroethylene	7	7	100.0%	43	64
	1,2-trans-dichloroethylene	7	0	0.0%	< 5	< 5
	Trichloroethylene	7	0	0.0%	< 5	< 5
	Tetrachloroethylene	7	0	0.0%	< 5	< 5
	Vinyl chloride	7	0	0.0%	< 5	< 5
MW-5	None detected	6	0	0.0%	—	—
MW-6	None detected	7	0	0.0%	—	—
MW-7	None detected	7	0	0.0%	—	—
MW-8	None detected	7	0	0.0%	—	—
MW-9	Benzene	4	0	0.0%	< 5	< 5
	Chloroethane	4	0	0.0%	< 5	< 5
	1,1-dichloroethane	4	0	0.0%	< 5	< 5
	1,2-dichloroethane	4	0	0.0%	< 5	< 5
	1,1,1-trichloroethane	4	0	0.0%	< 5	< 5
	1,1-dichloroethylene	4	0	0.0%	< 5	< 5
	1,2-trans-dichloroethylene	4	0	0.0%	< 5	< 5
	Trichloroethylene	4	3	75.0%	12	23
	Tetrachloroethylene	4	0	0.0%	< 5	< 5
	Vinyl chloride	4	0	0.0%	< 5	< 5

(1) Listed compounds include those VOCs detected in more than one well, and not indicative of laboratory sample contamination.

APPENDIX E
FIELD SAMPLING AND ANALYSIS PLAN

APPENDIX E
FIELD SAMPLING AND ANALYSIS PLAN

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E-1

TITLE

Analytical Methods Reference

APPENDIX E

FIELD SAMPLING AND ANALYSIS PLAN

E.1.0 INTRODUCTION

The field sampling and analysis plan (FSAP) describes the methods by which samples will be collected, handled, and analyzed to best assure quality data and successful project completion. This FSAP includes sections describing the following:

- Soil and water sampling
- Equipment decontamination
- Analytical methods
- Sample handling
- Sample tracking and documentation.

The methods to be utilized are described in the following sections of this FSAP.

E.2.0 FIELD OPERATIONS

E.2.1 EXCAVATED SOIL/WASTE SAMPLING

The purpose of sampling soils and wastes excavated during waste removal activities at the North End former disposal area remediation is twofold:

- Characterize soils and wastes removed from the landfill to determine which materials must be removed from the site and which can be used as backfill
- Determine how the removed materials need to be disposed.

E.2.1.1 Sample Locations

The estimated total amount of fill that will be excavated is 12,000 cubic yards (yd^3). Of this total, 6,000 yd^3 is estimated to be clean soils and 3,500 yd^3 is estimated to be a heterogeneous mix of soil and lead-bearing dust. A composite sample will be collected of each 500 yd^3 of those materials visually characterized as clean soils and of each 200 yd^3 of those materials visually characterized as dust-bearing. This sampling frequency results in an approximate total of 30 samples for analysis.

Waste volumes in windrows/stockpiles will be estimated for purposes of sampling frequency and sample location selection. For example, a 24-foot length of a triangular windrow 15 feet high with a 30-foot base would represent 200 yd^3 of material. This 24-foot section of dust-bearing soil would be sampled by compositing at the 6-, 12-, and 18-foot locations within the middles of both sidewalls. Accordingly, a 240-foot long windrow would be similarly sampled at 60 locations to collect 10 samples. Each 24-foot section of windrowed material would be subsequently handled according to the results of the sample representing that section.

E.2.1.2 Sample Collection

Composite samples will be collected by placing one trowel full of soil/waste from each location into a mixing bowl and thoroughly blending the

material before placing it into the sample container (i.e., 250-milliliter [ml] glass jar). A clean stainless steel trowel and stainless steel bowl will be used for each sample. This equipment will be cleaned before reuse via the method described in Section E.2.5.

E.2.1.3 Sample Analysis

All sample analyses will be conducted via U.S. Environmental Protection Agency (EPA) SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods." The specific analytical laboratory to perform this testing will be selected by Remcor and approved by Armco prior to the start of waste removal.

All soil samples will be analyzed for total lead by Methods 3050 (digestion) and 6010 (analysis). A sufficient quantity of each soil sample will be retained to run an extraction procedure (EP) toxicity extraction and analysis should the total lead result be greater than target cleanup levels (Appendix H). Initial laboratory results for total lead will be required within 24 hours of sample submittal so that materials can be moved as quickly as possible. EP toxicity analyses will be run by SW-846 Methods 1310 (extraction), 3010 (digestion), and 7420 (analysis). Sample container requirements, analytical methods, and holding times are summarized in Table E-1.

One field duplicate will be collected for every 20 samples, or fraction thereof, collected. If 30 samples are collected, 2 samples will be duplicated. Duplicates will be collected by simply filling an additional sample jar from the homogenized sample material in the mixing bowl. These duplicate samples will serve as one measure of laboratory precision.

E.2.2 CONFIRMATORY SOIL SAMPLING

Sampling of soils at the limits of excavation will be performed to confirm that the waste/soil removal in each excavation area has been completed. Confirmatory soil sampling results will be compared to site-specific target cleanup levels for lead (Appendix H) as the basis for

determination. Volatile organic compounds (VOCs) will also be screened at each confirmatory soil sampling location to provide further information on possible sources of local ground water contamination.

E.2.2.1 Sampling Locations

Confirmatory soil samples will be collected at a frequency of one sample for each 2,000 square feet (ft^2) of area of waste/soil removal. The excavation procedure calls for removal in stages or panels oriented north-to-south at the site; each excavation panel will be (nominally) 40 feet wide. Within each panel, therefore, confirmatory soil samples will be collected at 50-foot (north-to-south) centers. Based on an expected area of removal of 85,000 ft^2 and allowing for unexcavated areas (e.g., HCl storage tank), there will be approximately 43 confirmatory soil sampling locations. In addition, confirmatory soil samples will be collected at 50-foot centers along the outside perimeter of the excavation area. These samples will be taken from the mid-height on the excavation face. An estimated 30 confirmatory soil sampling locations will be spaced along the outer excavation face. Figure 7 shows some approximate confirmatory sample locations.

E.2.2.2 Sample Collection

Soil samples will be collected at each confirmatory sampling location by means of a bucket-type hand auger or spade. Soil sampling will extend to a depth of 12 inches at each location with the collected soils segregated by depth into two fractions:

- 0- to 6-inch depth
- 6- to 12-inch depth.

A total of approximately ¹³⁶~~16~~ soil samples will be collected.

Approximately 50 grams of the collected soil at each location and at each depth will be placed in a 1,000-ml glass jar for field headspace screening for VOCs. The remainder of the sample will be placed in the following containers for laboratory analysis:

- 250-ml glass jar for lead analysis
- 250-ml glass jar with Teflon[™]-lined lid for priority VOC analysis.

The bucket auger or spade will be decontaminated prior to each use by the method described in Section E.2.5.

E.2.2.3 Sample Analysis

The upper (0- to 6-inch) sample will first be analyzed for total lead concentration from each location. Analyses will be performed by Methods 3050 (digestion) and 6010 (analysis) as defined in EPA SW-846. Laboratory results will be required on a 24-hour turnaround.

If ~~the upper soil sample exhibits a total lead concentration in excess~~ *is not achieved in any excavation stage, one or more of* of the applicable target cleanup level, the lower soil samples from that ~~location~~ *excavation area* will be similarly analyzed. If further excavation is required to achieve the target cleanup levels, the sampling and analysis procedure will be repeated at the corresponding confirmatory sampling locations.

Headspace VOC screening will be performed by the following procedure:

- Place approximately 50 grams of soil in a 1,000-ml glass sample container
- Cover the container opening with aluminum foil securely fastened with plastic tape
- Allow the sample to stand at least 10 minutes at normal room temperature (70°F)
- Insert the probe of the organic vapor analyzer (OVA) (either flame-ionization or photoionization type) into the air space of the container, piercing the aluminum foil cover
- Record the immediate (peak) organic vapor concentration in the air space of the container.

Any sample where a positive OVA reading is recorded (i.e., peak concentration at least 2.5 times background) will be submitted for laboratory analysis of priority pollutant VOCs. If no positive readings occur, three randomly selected samples will be submitted for laboratory analysis. One of these "clean" samples can be omitted for each two

"positive" samples submitted to the laboratory, provided a minimum of one "clean" sample is analyzed. All priority VOC analyses will be conducted in accordance with Method 8240 as per EPA SW-846.

The laboratory will also prepare two blind spike samples prepared with known concentrations of 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE). These spike samples will be field-screened for VOCs using the OVA prior to the initiation of field screening of confirmatory soil samples. In this manner, the effectiveness of the field OVA screening will be confirmed before its field implementation.

E.2.3 GROUND WATER SAMPLING

The collection of ground water samples will conform to the methods and procedures currently in use for the quarterly monitoring at the UWR plant site. Each well will be purged and sampled with dedicated stainless steel and/or Teflon™ bailers. Samples will be numbered according to the scheme presently in use at the site, which designates the well number as well as sampling round. Samples will be collected from the new wells during the fourth quarter of 1989 and the first quarter of 1990 (10th and 11th sampling rounds).

Ground water samples will be analyzed for the following parameters:

- pH
- Specific conductance
- Alkalinity
- Nitrates
- Phenolics
- Lead (total and dissolved)
- Priority pollutant VOCs
- Polychlorinated biphenyls (PCBs).

Each sample bottle will be prepared with the appropriate preservative and sealed by the laboratory prior to field sampling. Sample container requirements, analytical methods, and holding times are summarized in Table E-1.

Field measurements of pH, temperature, and specific conductance will be conducted. At the completion of purging each well and prior to sampling, field measurements of each of these parameters will be made. Each well will then be sampled. In no case will the sampling occur more than 24 hours after purging.

E.2.4 WASH WATER SAMPLING

Spent wash waters generated at the equipment decontamination pad will be collected in a tank associated with that pad. A total spent wash water volume of not more than 7,500 gallons is expected. These wash waters will be sampled and subsequently handled on a batch basis, with each batch equal to not more than 67 percent of the receiving tank capacity.

Once the water storage tank becomes two-thirds full, the collected wash waters will be sampled. Sampling will be accomplished by means of a glass thieving rod with access gained through one or more tank entry ports. A minimum of 750 ml of sample will be withdrawn and placed in the following containers:

- 500-ml plastic bottle (unpreserved) for general chemistry
- 250-ml plastic bottle preserved with nitric acid to a pH <2 for total metals.

Sample container requirements, analytical methods, and holding times are summarized in Table E-1. Sample handling, documentation, and shipment methods will follow those used for ground water samples; a qualified analytical laboratory local to the Kansas City area may be used for testing. Analytical parameters are the following:

- pH
- Solids (total dissolved, total suspended)
- Total lead
- Total zinc
- Total cyanides
- Priority pollutant VOCs.

Analytical methods will be in accordance with SW-846 or approved equivalent.

E.2.5 FIELD DECONTAMINATION

E.2.5.1 Sampling Equipment Decontamination Procedures

This section details decontamination sequences to be followed for reusable sampling and drilling equipment. All expendable equipment (e.g., bailer drop lines) will be dedicated to single samples and discarded after use. Dedicated sampling devices will be used where practical, obviating the need for field decontamination. When use of dedicated equipment is not feasible, field decontamination will be required. Field decontamination will occur as few times as possible per field investigation to minimize the risk of cross contamination. Each field decontamination process will be recorded in the field log book as it is performed. Field decontamination consists of the following:

- Use of steam cleaner to strip visible dirt from equipment
- Rinse with solvent
- Rinse with deionized water
- Rinse with dilute acid
- Rinse with deionized water
- Air dry equipment and package in aluminum foil.

If a steam cleaner machine is not available, a soap and water wash and deionized water rinse will serve as the initial step. Field decontamination documentation will be kept in the field log. Rinsate from decontamination procedures will be contained by a plastic-lined basin. Upon completion of the decontamination, the rinsate will be containerized and transported to temporary storage at the site to await off-site removal. This rinsate will be sampled and analyzed for total lead and priority pollutant VOCs to determine proper treatment and disposal at the completion of the field activities.

E.2.5.2 Drilling and Heavy Equipment Decontamination Procedures

All drilling and heavy equipment will be decontaminated by high-pressure steam at a designated decontamination pad. The pad will be constructed of a three-sided, wooden plank frame, lined with a heavy plastic tarpaulin. The pad will be designed to be stationary since the site area is

relatively small and access can be controlled. The pad will be situated on a gentle slope and the equipment will be driven to the pad. All water associated with the decontamination process will drain to the low end of the pad where it will be collected in 55-gallon U.S. Department of Transportation (DOT) approved drums. The drums will be transported to a temporary storage area at the plant to await proper disposal. It is anticipated that these waters will be filtered through activated carbon filters and discharged to the publicly owned treatment works (POTW) under an industrial discharge permit with the city of Kansas City.

E.2.6 SAMPLE PACKAGING AND SHIPPING

All analytical samples collected will adhere to the following procedure:

- Label the sample by completing and affixing a sample label
- Add preservatives, where required
- Tape the bottle closed with polyvinyl chloride (PVC) electrical tape
- Fill out the required sample documentation (e.g., chain-of-custody [COC] and sampling log forms)
- Pack samples for shipping.

All samples will be stored in coolers immediately after collection and preparation. Vermiculite (or approved equivalent) will be used as a packing material because it is light, absorbent, inert, and absorbs shock well. Sealed ice packs will be kept within the cooler to chill the environmental samples. Methods of packaging and shipping of samples will be consistent with applicable DOT regulations.

E.2.7 SAMPLE TRACKING AND DOCUMENTATION

Each sample will be tracked by Remcor from the time of collection through ultimate data reporting. Samples will be affixed with labels that provide sample number, project number, sample analysis, date and time of collection, and sampler's initials. All pertinent facts regarding each sample will also be recorded onto a sample log. These logs

will provide detailed information regarding location of the sample, analyses to be performed, and facts about the physical collection of the sample.

COC procedures will be strictly maintained throughout this project. Upon collection of each sample, it will be logged onto a COC form. The COC form will serve as documentation of each person to have custody of the samples. When samples are shipped to the laboratory by air carrier, the air bill number will be recorded onto the COC form and the shipper's copy of the air bill will be kept to supplement the COC.

APPENDIX E
TABLE

TABLE E-1
ANALYTICAL METHODS REFERENCE

PARAMETER	CONTAINER TYPE (1)	PRESERVATIVE	HOLDING TIME	ANALYTICAL METHOD (2)	DETECTION LIMIT
<u>Water:</u>					
pH	500 or 1,000-ml P	4°C	Immediately	9040	±0.01 pH unit
Total Suspended Solids	500 or 1,000-ml P	4°C	7 days	160.2	0.1 mg/l
Total Dissolved Solids	500 or 1,000-ml P	4°C	7 days	160.1	1 mg/l
Specific Conductance	1,000-ml P	4°C	28 days	9050	1 µmho/cm
Alkalinity	1,000-ml P	4°C	14 days	310.2	1 mg/l CaCO ₃
Phenolics	1,000-ml G	4°C; H ₂ SO ₄ to pH <2	28 days	9066	0.01 mg/l
Nitrate	250-ml P	4°C; H ₂ SO ₄ to pH <2	14 days	9200	1 mg/l
Total Lead	250-ml P	HNO ₃ to pH <2	6 months	7420 or 6010	0.001 mg/l
Total Zinc	250-ml P	HNO ₃ to pH <2	6 months	7950	0.01 mg/l
Priority Pollutant Volatile Organics	40-ml G vials (2)	4°C; seal with- out air space	14 days	8240	5 to 250 µg/l

See footnotes at end of table.

TABLE E-1
(Continued)

PARAMETER	CONTAINER TYPE (1)	PRESERVATIVE	HOLDING TIME	ANALYTICAL METHOD (2)	DETECTION LIMIT
Total Cyanides	1,000-ml P	NaOH to pH >12	14 days	9012	0.01 mg/l
Polychlorinated Biphenyls	1,000-ml G	4°C	40 days after extraction	8080	0.001 mg/l
<u>Solids:</u>					
Total Lead	250-ml G	None	6 months	7420 or 6010	10 µg/g
Extraction Procedure Toxic Lead	250-ml G	None	6 months	1310, (3) 7420	0.1 mg/l
Priority Pollutant Volatile Organics	250-ml G with Teflon [™] - lined lid	4°C	14 days	8240	5 µg/kg

(1) "p" indicates plastic; "G" indicates glass.

(2) All methods, except those for solids and alkalinity, reference U.S. Environmental Protection Agency (EPA) SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," November 1986. The alkalinity method reference is EPA 600/4-79-0201.

(3) Analytical Method 1310 is the extraction method.

APPENDIX F
QUALITY ASSURANCE PROJECT PLAN

APPENDIX F
QUALITY ASSURANCE PROJECT PLAN

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APPENDIX F
QUALITY ASSURANCE PROJECT PLAN

F.1.0 INTRODUCTION

The Quality Assurance Project Plan (QAPP) is intended to document the site-specific objectives, policies, organizations, functional activities, and quality assurance/quality control (QA/QC) activities designed to achieve the data quality objectives of the activities mandated by the Consent Order and Agreement (COA) for the remediation of the North End former disposal area at the Union Wire Rope (UWR) facility in Kansas City, Missouri. All sampling and analysis activities will comply with the QAPP. The Field Sampling and Analysis Plan (FSAP) developed for the remediation under the COA is consistent with the QAPP. The FSAP is referenced where appropriate throughout the QAPP. The QAPP was developed in accordance with "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (U.S. Environmental Protection Agency [EPA], 1983).

F.2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Armco Inc. (Armco) will have overall responsibility for the execution of the remediation of the North End former disposal area and monitoring the activities of their technical consultant, Remcor, Inc. (Remcor). Remcor will have the responsibility for implementing all aspects of the remediation. Remcor will perform or supervise all field activities and will be responsible for the activities of all subcontractors. Additionally, Remcor will provide QA/QC for all field activities and all deliverables.

The management, technical, and QA/QC responsibilities of the key project personnel are as follows:

- Project Director - Mr. Leo M. Brausch:
 - Assist the project manager in project planning activities
 - Attend major scoping and review meetings among Remcor, Armco, EPA, and COE
 - Coordinate regularly with the project manager on progress in the areas of site activities, budget, and schedule
 - Review all project documents.
- Project Manager - Mr. Steve J. Knezovich:
 - Organize and schedule Remcor staff for assigned tasks
 - Coordinate subcontractor activities
 - Control schedules and budgets
 - Establish project records
 - Coordinate with the health and safety personnel for the project
 - Participate in project meetings with Armco
 - Review all project reports.
- QA Officer - Mr. Edward L. Baer:
 - Schedule and perform systems audits
 - Initiate corrective action
 - Overview laboratory activities
 - Determine laboratory data corrective action

- Coordinate analytical data validation and review
- Review laboratory QA/QC
- Review all project documentation (site and sample logs, chain-of-custody [COC] forms, etc.).
- Project Engineer - Mr. Neil K. Cope:
 - Develop materials handling plan
 - Provide technical guidance in support of the excavation and materials handling, as needed
 - Assist the project manager, as needed.
- Project Geologist - Mr. Dayne M. Crowley:
 - Implement ground water monitoring plan, including design of new wells and oversight of well installation
 - Perform ground water pumping tests
 - Perform ground water sampling.
- Field Superintendent - Mr. David R. Kasper:
 - Supervise excavation and materials handling work crew
 - Oversee soil sampling.

The proposed project laboratory is Wilson Laboratories (Wilson) of Salina, Kansas. Wilson is a participant in the EPA Contract Laboratory Program (CLP) for both inorganics and organics. They have shown proficiency in performing all the analyses planned for the North End remediation. Their proximity to the site will allow for rapid turnaround of lead and volatile organic compound (VOC) soil results, which will permit continual progress of the remediation activities.

Because of the uncertainty of the time frame for this project, it is prudent to identify alternative laboratories for conduct of the rapid-turnaround analyses. If Wilson is unable to meet the turnaround demands of this project at the time of initiation, Remcor will utilize Langston Laboratories of Leawood, Kansas and/or EMS Laboratories of Kansas City, Missouri. Both of these laboratories are CLP participants for organics.

(All laboratories will follow all QA/QC procedures of the analytical methods proposed for this project and those in their corporate QA manual, as well as those in this QAPP. The corporate QA manuals of all laboratories to be utilized and descriptions of personnel responsibilities can be submitted to the EPA project officer.

Primary responsibility for data quality rests with Remcor's QA officer. Ultimate responsibility for project quality rests with Remcor's project manager. Independent QA will be provided by the contractor laboratory's project manager and QA/QC officer prior to release of the data to Remcor.

F.3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

F.3.1 DATA USES AND QUALITY OBJECTIVES

The chemical/analytical data collected during the performance of the UWR North End disposal area remediation is intended for the following uses:

- Definition of limits of contamination and characterization for disposal
- Evaluation of hydrogeologic conditions for assessment of source control measures.

The first of these uses falls into the category of engineering design. The second use falls into the categories of site characterization and evaluation of alternatives.

A primary component of data quality is selection of the appropriate analytical level for the intended data use. The analytical levels, as described in "Data Quality Objectives for Remedial Response Activities" (EPA, March 1987), are as follows:

- Level I - Field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative but results are available in real-time. It is the least costly of the analytical options.
- Level II - Field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on site. There is a wide range in the quality of data that can be generated. It depends on the use of suitable calibration standards, reference materials, and sample preparation equipment; and the training of the operator. Results are available in real-time or several hours.
- Level III - All analyses performed in an off-site analytical laboratory. Level III analyses may or may not use CLP procedures, but do not usually utilize the validation or documentation procedures required of CLP Level IV analysis. The laboratory may or may not be a CLP laboratory.
- Level IV - CLP routine analytical services (RAS). All analyses are performed in an off-site CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.

- Level V - Analysis by nonstandard methods. All analyses are performed in an off-site analytical laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP special analytical services (SAS) are Level V.

Analytical Level III will be used for the excavation control and the additional ground water testing. Level III analyses will be conducted in accordance with EPA SW-846, "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods" (EPA, November 1986). The Level III analytical level is more than sufficient for determining whether soil samples collected during excavation of lead-bearing soils contain more than the action level concentration of lead set for determining which soil will be removed from the disposal area. Extraction procedure (EP) toxicity testing requires Level III analysis because this test will determine whether the materials are disposed as nonhazardous or hazardous wastes. Ground water samples will require Level III analyses because accurate identification and quantitation will be necessary for evaluating alternatives.

F.3.2 MEASUREMENT PARAMETERS

Data quality can be measured via the following indicator parameters:

- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability.

F.3.2.1 Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. Precision of Level III data can be measured via the analysis of field duplicates, laboratory duplicates, and matrix spike duplicates. The frequency of field duplicate collection and analysis is specified in Chapter F.9.0 and in the FSAP. The frequency of laboratory duplicate and matrix spike duplicate analysis are specified in Chapter F.9.0. Reproducibility is expressed as a relative percent

difference (RPD), which is the absolute value of the range between the duplicate results divided by the mean. Acceptable RPDs for each analyte are given in the applicable methods.

F.3.2.2 Accuracy

Accuracy is a measure of the bias (i.e., error) in a measurement system. Accuracy of Level III data can be measured by the analysis of field blanks, trip blanks, method blanks, matrix spikes, and surrogated standards. Blanks provide a way of detecting biases introduced in the sampling, sample handling, and analysis. Matrix spikes and surrogates measure the efficiency of the recovery (in percent) of known quantities of contaminants. The frequency of field blank and trip blank collection and analysis is specified in the FSAP. The frequency of analysis of method blanks, matrix spikes, and surrogate standards are specified in Chapter F.9.0. The methods also present the acceptable percent recovery limits for each analyte.

F.3.2.3 Representativeness

Representativeness is a relatively subjective measure of the degree to which the sampling methodologies permit collection of typical samples. Representativeness is a function of the sampling program and is addressed by aiming to collect an adequate number of samples from optimal locations using standard procedures. The number and location of samples and the rationale and methodologies of sampling are described in the FSAP.

F.3.2.4 Completeness

Completeness is a qualitative measure of the percentage of all measurements judged to be valid results. Completeness is important because a certain amount of invalid data will make sampling and analysis objectives unattainable. Thus, acceptable percentages of data determined to be valid should be established as goals to be attained for each particular objective. Anything below these goals would require resampling and reanalysis. Historical data on the completeness achieved by particular

methods do not exist. EPA CLP data have been found to be 80 to 85 percent complete. Thus, 85 percent completeness is the goal for all Level III analytical data for the North End study and remediation.

F.3.2.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared against another. Comparability is a qualitative function of the sampling and analysis methods. To assure that one data set can be compared to another, standard sampling and analysis methods that are well documented must be used. The sampling and analysis methods to be used for the North End study and remediation are described in the FSAP. The sampling and analysis methods follow well-documented standard procedures and will provide a data base that can be compared with another obtained in the same fashion.

F.4.0 SAMPLING PROCEDURES

The investigation objectives and sampling procedures are described in the FSAP. The FSAP describes the following elements:

- Sample types, locations, and numbers
- Sampling procedures
- Analytes for each sample
- Sample containers, preservatives, and holding times
- Sampling equipment and equipment decontamination
- Sample packaging and shipping
- Sample custody and documentation
- QC samples.

F.5.0 SAMPLE CUSTODY

Sample custody procedures are described in Sections E.2.5 and E.2.6 of the FSAP.

F.6.0 ANALYTICAL PROCEDURES, CALIBRATION PROCEDURES, AND FREQUENCY

F.6.1 LABORATORY ANALYSES AND INSTRUMENT CALIBRATION

Laboratory analyses will be performed in accordance with the methods listed in Table F-1. EPA SW-846 methods will provide Level III analytical data quality. Instrument calibration will be performed according to the procedures and at the frequencies specified below.

F.6.1.1 Gas Chromatograph and Gas Chromatograph/Mass Spectrometer Analyses

Initial and continuing calibration of gas chromatograph and gas chromatograph/mass spectrometers (GC/MS) will follow CLP requirements.

F.6.1.2 Metals Analyses

Calibration of atomic absorption (AA) and inductively coupled plasma (ICP) units will be conducted as follows:

- Initial Calibration:
 - AA units will be calibrated at the start of each run according to manufacturer's instructions, using a blank, a mid-range standard, and an upper-range standard. ICP units will be calibrated at the start of each run according to manufacturer's instructions.
 - A reporting limit standard will also be run to verify instrument sensitivity; this standard must be detected before proceeding with analysis.
 - Immediately after initial calibration, an independent standard will be run to verify the initial calibration. Recovery of the standard must be 90 to 110 percent (80 to 120 percent for mercury) prior to proceeding with analysis.
- Continuing Calibration:
 - After 10 samples and at the end of the run, a continuing calibration standard will be run. Recovery must be 90 to 110 percent (80 to 120 percent for mercury). If recovery does not meet acceptance criteria, the system will be recalibrated and all samples run since the last acceptable calibration check will be rerun.

- A continuing calibration blank will also be run after each continuing calibration standard. Baseline shift must not exceed the reporting limit.

F.6.1.3 Inorganic Chemistry Analyses

Inorganic chemistry analyses will require calibration by the following procedures:

- Initial Calibration:

- For colorimetric techniques, a blank and a minimum of two standards (a mid-range standard and an upper-range standard) will be used for calibration. A response factor (RF) will be calculated for each standard. If the relative standard deviation (RSD) of the RFs is less than or equal to 7.5 percent, quantitation will be performed using the average RF. If the RSD of the RFs is greater than 7.5 percent, quantitation will be performed from a calibration curve. For those tests for which a standard curve is not prepared daily, three replicates of each standard will be run; the average of the replicates will be used to calculate a RF. Table F-2 lists the frequency of initial calibration for individual tests. A reporting limit standard will also be run daily; this standard must be detected (discernible from zero) prior to continuation of analysis.
- For titrimetric techniques, the titrant will be standardized against a primary standard at the frequency listed in Table F-2. A standard will be run daily to verify the standardization.
- For potentiometric techniques, the meter will be calibrated at the start of each run according to manufacturer's instructions using a blank and a minimum of two standards (a mid-range standard and an upper-range standard). A reporting limit standard will also be run daily. This standard must be detected (discernible from zero) prior to continuation of analysis.

- Continuing Calibration (CC):

- A CC standard will be run after each set of 10 samples and at the end of the run as shown in Table F-2. Recovery of the standard must be 90 to 110 percent. If acceptance criteria are not met, all samples analyzed since the last acceptable CC standard will be rerun.

F.6.2 FIELD MEASUREMENTS AND INSTRUMENT CALIBRATION

Level I analytical data will be collected with field instruments including an organic vapor meter (OVM), pH meter, specific conductance meter, and thermometer. Calibration of these instruments will be performed at least daily, for each day that they are used. Operation and calibration of these instruments will be conducted as follows.

HNu™ Organic Vapor Analyzer (OVA)

- Operating Procedures:

- Connect the probe cable plug to the 12-pin keyed socket on the readout assembly panel. Carefully match the alignment slot in the plug to the key in the connector. Screw down the probe connector until a distinct snap and lock is felt.
- Screw the probe extension into the probe end cap. The probe may be used without the extension, if necessary.
- Set the SPAN control for the probe being used (10.2, 9.5, or 11.7 eV) as specified by the initial factor calibration or by subsequent calibrations.
- Turn the function switch to the BATT (battery check) position. The needle on the meter will go to the green zone if the battery is fully charged. If the needle is below the green arc or if the Low Battery Indicator comes on, the battery must be recharged before the analyzer is used.
- Set the SPAN pot to the desired value based on the gas to be used.
- Turn the function switch to the appropriate operating position. Start with the 0 to 2,000 position and then switch to the more sensitive ranges. The ultraviolet (UV) light source should be on, confirmed by briefly looking into the probe to observe a purple glow from the lamp.

- Calibration Procedure:

- Battery Check - Turn the function switch to BATT. The needle should be in the green region. If not, recharge the battery.
- Zero Set - Turn the function switch to STANDBY. In this position, the lamp is OFF and no signal is generated.

Set the zero point with the ZERO set control. The zero can also be set with the function switch on the X1 position using a "Hydrocarbon-free" air. In this case, "negative" readings are possible if the analyzer measures a cleaner sample when in service.

- Lamp Cleaning - If the span setting resulting from calibration is 0.0 or if calibration cannot be achieved, then the lamp must be cleaned.

pH Meter

Field determination of pH in water will be made by use of an analog display, self-contained, battery-operated pH meter (Hach Mini pH Meter, Model 17200). Prior to use of this instrument, the following standardization procedure will be performed. Buffer solutions of pH 4.00 and 7.00 will be mixed by adding 50 milliliters (ml) of deionized water to each of the respective buffer powder ampules provided with the unit. The temperature of the buffer solutions will be measured and the meter will be adjusted for that temperature per manufacturer's instructions.

The protective cap will then be removed from the probe and the reference electrode solution fill hole on probe will be exposed. The pH probe must be thoroughly rinsed with deionized water prior to each use. Once the temperature of the buffer solution has been set on the instrument, the probe will be immersed in the pH 7.00 solution and the instrument will be set to read 7.0. Following a rinse of the probe, it will be immersed in the pH 4.00 solution and the span will be adjusted so that the instrument reads 4.0. The pH meter will, at this time, be standardized.

Measurement of pH on field samples will be made as soon as possible after sample collection. The pH value will be recorded to the nearest 0.1 standard unit.

Temperature Measurement

Temperature will be measured on all aqueous samples upon collection. Temperature will be measured with a standard field thermometer calibrated at 10 degrees Celsius (°C) and 45°C to a National Bureau of

Standard (NBS) specification thermometer. The thermometer will be rinsed between each use with deionized water (reducing the possibility of altering pH and/or conductance of the sample). The temperature will be recorded to the nearest 0.5°C.

Conductivity Meter

Field determinations of specific conductance will be made by field personnel using an analog display, battery-operated conductivity meter (Hach Mini Conductivity Meter, Model 17250). The conductivity meter will be standardized using a 1.413.0 micromhos/centimeter ($\mu\text{mhos/cm}$) potassium chloride (KCl) solution. The cell constant will be calculated per the following equation:

$$C = \frac{(1413.0) [1+0.0191(t-25)]}{K_s}$$

where:

C = cell constant

t = observed temperature (°C)

K_s = measured conductance (μmhos) of standard KCl solution.

Conductivity (K) will be calculated from samples measured in the field by applying the following formula:

$$K = \frac{K_m(c)}{1+0.0191(t-25)}$$

where:

K = conductivity (μmhos) of environmental sample corrected for temperature and cell response

K_m = measured conductivity in μmhos at temperature = t

t = observed temperature (°C)

c = cell constant (cm^{-1}).

The measurement of the conductance of the standard will be made at a known temperature as close to 25°C as practical. If, upon standardization of the meter, the conductance meter reading differs by more than 5 percent from the solution conductance, the meter will be adjusted. This adjustment will be made by fine tuning of the STD potentiometer on the circuit board to obtain the correct reading.

After the meter has been standardized and the probe thoroughly rinsed with deionized water, conductance measurements may be made on water samples. Upon collection of the sample, the temperature will be measured and the meter will be set for that temperature. The conductance probe is then immersed into the sample permitting the vent holes to be submerged. The instrument is then turned on and the range selector is adjusted giving the smallest range permitting the conductance measurement. Conductivity measurements will be recorded in $\mu\text{mhos/cm}$.

F.7.0 DATA REDUCTION, VALIDATION, AND REPORTING

F.7.1 LABORATORY DATA REDUCTION, VALIDATION, AND REPORTING

The contract laboratory will perform analytical data reduction and validation in accordance with the methods in EPA SW-846, and in accordance with their corporate QA program. This QA program manual will be forwarded to the EPA prior to initiation of the project. Data reduction, validation, and reporting by the laboratory will be conducted as follows:

- Each analyst will record the analytical data in the appropriate analysis logbook
- The laboratory supervisor and/or group leader will review the analysis logbook and the associated standard curves, instrument printouts, and QC data for completeness, accuracy of calculations, and conformance to the QC requirements
- The laboratory project manager will review the deliverables for compliance with project requirements and approve the data package for release to the client.

The deliverables for EPA SW-846 data will include test results and the following QC documentation:

- Duplicate, spike, and matrix spike duplicate results
- Surrogate recoveries
- Standard and blank results.

F.7.2 REMCOR DATA REDUCTION, VALIDATION, AND REPORTING

Upon receipt of data from the contracted laboratory, Remcor personnel will ensure that all data packages are complete. Remcor personnel will be responsible for transcribing all data into tables suitable for data review and validation. Remcor personnel will review EPA SW-846 data to ascertain that the laboratory has provided the following information:

- Correct reporting units
- Documentation of acceptable matrix spike duplicate and surrogate recoveries

- Acceptable standard and preparation blank results
- Appropriate qualifiers of data for which results are reported below the method detection limit or for analytes that are also detected in method or preparation blanks.

Remcor will also review data for significant discrepancies between field- replicate results and for field blank contamination. If either is found, affected data will be appropriately qualified or invalidated. Upon completion of all data review and validation, Remcor personnel will prepare data tables showing all appropriate qualifiers and invalid data.

F.8.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

F.8.1 FIELD QC

Precision and accuracy of field measurements will be maintained two ways:

- Through daily calibration of each instrument as per the procedures outlined in Chapter F.6.0
- By checking the reproducibility of the measurement by obtaining and recording multiple readings.

QC of field sampling will be maintained by collection of the following QC samples:

- Field duplicates
- Field blanks
- Trip blanks.

One sample will be duplicated for every 20 samples, or fraction thereof, of each media. For example, 30 soil/waste samples will require two duplicate samples. These field duplicates will serve as one measure of laboratory precision.

Field blanks will be collected for every 20 aqueous samples, or fraction thereof. Field blanks will be rinsate blanks, comprised of laboratory-supplied, analyte-free water poured through the applicable sampling apparatus (e.g., bailer) before being poured into the appropriate sample bottles. These samples will serve as a check on potential contamination being introduced by sampling equipment.

A trip blank will accompany each shipping container carrying VOC analysis samples to the laboratory. Trip blanks will be comprised of laboratory-supplied, analyte-free water. Trip blanks will be supplied by the analytical laboratory and will accompany the sample bottles to the site and remain in the sample coolers throughout the sampling exercise. Trip blanks serve as a check on potential sample cross contamination with VOCs during bottle and sample storage and shipment.

The number of QC samples anticipated for each sampling activity is presented in the FSAP.

F.8.2 LABORATORY QC

F.8.2.1 Method/Reagent Blanks

A method blank will be prepared and analyzed with each batch of up to 20 samples of similar matrix (water or soil/sediment/waste). If target analytes are detected in a blank at or above the reporting limit, the samples associated with that blank that also contain the analyte(s) in question at levels at the reporting limit to 10 times the level found in the blank will be reanalyzed, with the following exceptions:

- Volatiles - Common laboratory solvents may be present at levels up to five times the reporting limit. The sample results associated with such a blank will be qualified to denote the presence of the analyte in the blank.
- Semivolatiles - Common phthlate esters may be present at levels up to five times the reporting limit. The sample results associated with such a blank will be qualified to denote the presence of the analyte in the blank.

F.8.2.2 Duplicates, Matrix Spikes, and Matrix Spike Duplicates

These laboratory QC samples will be prepared and analyzed at the following frequencies:

- GC and GC/MS Analyses - Duplicate aliquots of 1 in 20 samples of similar matrix (water or soil) will be spiked with the matrix spiking cocktail for volatiles. CLP acceptance limits will be applied.
- Metals and Inorganic Chemistry Analyses - One in 20 samples will be analyzed in duplicate and as a matrix spike, where appropriate to the method. CLP acceptance limits will be applied.

F.8.2.3 Surrogate Standards - GC and GC/MS Analyses

All samples, blanks, and duplicate matrix spikes will be spiked with surrogate standard cocktails. If CLP recovery limits are not met, the sample will be reanalyzed once. If recovery remains outside acceptance

(limits, the presence of a matrix interference will be assumed; no further action will be taken.

F.8.2.4 Laboratory Control Standards (LCS) - Metals and Inorganic Chemistry Analyses

An LCS will be prepared and analyzed with each batch of up to 20 samples of similar matrix (water or soil). Acceptance limits of 75 to 125 percent recovery will be applied to LCS recovery. If acceptance limits are exceeded, the batch of samples will be reanalyzed, unless it is evident that the problem was with the LCS spiking standard itself.

F.9.0 PERFORMANCE AND SYSTEMS AUDITS

QC samples including duplicates, matrix spike duplicates, surrogates, and reagent blanks will be used to evaluate the performance of the contract laboratory in analyzing samples for the UWR project. No project-specific performance audit will be performed; the analytical laboratories will be verified for proficiency in performing the analyses that are required for this project.

Systems audits will be performed by or under the direction of the Remcor QA Officer to evaluate field activities, including soil sampling and monitoring well installation and sampling. This will require one audit. Specific elements of the on-site audit include verification of the following:

- Adherence to sample collection, preparation, preservation, and storage procedures outlined
- Adherence to proper field measurement and calibration procedures
- Completeness and accuracy of field notebooks, including documentation of times, dates, drillers' names, sampling methods, sampling locations, number of samples, sampling personnel, types of samples, field measurements, soil logs, and any problems encountered during sampling
- Completeness and accuracy of sampling COC forms, including documentation of times, dates, transaction descriptions, and signatures
- Completeness and accuracy of sample identification labels, including notation of time, date, location, type of sample, personnel, preservation, and analytical procedure required
- Adherence to health and safety guidelines outlined, including wearing of proper protective clothing
- Adherence to decontamination procedures outlined.

F.10.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULE

F.10.1 REMCOR FIELD EQUIPMENT

Remcor's field equipment is maintained through the use of field check summary sheets that identify the most recent maintenance, battery charge, and condition of the equipment. When damaged equipment is returned to the equipment supply room, it is appropriately flagged for the required repairs or maintenance needed. This process assures that only operable and maintained equipment enters the field. Routine daily maintenance procedures conducted in the field include:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems
- Cleansing of filters in an OVA
- Storage of equipment away from the elements
- Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing or weak batteries).

Spare and replacement parts stored in the field to minimize downtime include:

- Appropriately sized batteries
- Locks
- Extra sample containers
- Bailer line
- Bailers
- HNu™ calibration kit, battery charger, and support equipment
- Tool kit.

Monitoring equipment is seldom repaired in the field; rather, Remcor has the capability to mobilize replacement instruments to the UWR site within 24 hours, should the need arise.

F.10.2 LABORATORY EQUIPMENT

Laboratory preventive maintenance procedures are presented the laboratory QA/QC Manual, which will be forwarded to the EPA project officer.

F.11.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

F.11.1 FIELD MEASUREMENT DATA

Historic data are not available to be used as a basis for establishing quantitative criteria. However, precision, accuracy, and completeness will be calculated for all field measurements obtained during the UWR project. This section provides the basis for such calculations. Field instruments for environmental measurements to be used include an OVM, pH meter, conductivity meter, and field thermometer.

Accuracy

Accuracy is defined as proximity to the known value; in all cases during the UWR project, the known value will be a standard used in the calibration of the instrumentation. Accuracy is measured as percent bias, by the following equation:

$$\left(\frac{X-K}{K}\right) \times 100\%$$

where:

X = the mean value of a series of measurements

K = the known value, or calibration standard.

It is important to know the percentage by which field instrument readings are either consistently lower (negative bias) or higher (positive bias) than the known value. The procedures to be used in calibrating each of the field instruments are discussed in Chapter F.6.0. Measurements of the accuracy of the instrument will be made by first calibrating the instrument and then making a series of 10 measurements on the calibration standard. The deviation of the average of these 10 measurements from the standard value, expressed as a percentage, will be recorded as the bias for that sampling effort. Accuracy of the field instrument will be checked with each recalibration, as required.

Precision

Precision reflects the "reproducibility" of a series of measurements made with an individual instrument under specific conditions. Precision will be reported as the standard deviation of a data set from the mean value for that set, in accordance with the following equation, summing the variations of each of the observations from the group mean and dividing by an appropriate number of degrees of freedom:

$$s = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}$$

where:

s = sample standard deviation

$\sum_{i=1}^n$ = summation from the first through the nth value

n = number of observations

x_i = the ith individual observation

\bar{x} = the mean value of all n observations

n-1 = number of observations minus 1 (degrees of freedom).

Completeness

Completeness of the data set is expressed as the number of completed analyses versus the number attempted per the following equation:

$$\left(\frac{x}{y}\right) \times 100\%$$

where:

x = number of measurements completed

y = number of measurements attempted.

F.11.2 LABORATORY ANALYSIS

Data precision, accuracy, and completeness will be calculated in accordance with the procedures specified in the appropriate EPA SW-846 method.

F.12.0 CORRECTIVE ACTION

F.12.1 REMCOR CORRECTIVE ACTION

Field QA activities will be reported to the project manager and QA officer. Problems encountered during the study affecting QA will be reported. The project manager/QA officer will be responsible for initiating the corrective actions and for ensuring that the actions are taken in a timely manner and that the desired results are produced. All corrective actions taken will be reported to the EPA project officer.

Corrective actions for the laboratory analytical work will be consistent with the contract laboratory's internal QC program. The contract laboratory will provide documentation as to what, if any, corrective actions were initiated. A copy of the contract laboratory's QA/QC manual will be forwarded to the EPA project officer for review.

F.12.2 LABORATORY CORRECTIVE ACTION

An anomalous event, from sample receipt through report delivery, that is contrary to good laboratory practice and/or the requirements of the laboratory QA program is an out-of-control event. The treatment of these events is outlined through the examples that follow.

F.12.2.1 Corrective Action During Check-In

The sample custodian checks the samples, field, trip, and rinsate blanks against the shipping document or field chain of custody. If discrepancies exist, the sample custodian will document them and notify the project manager. The project manager will then notify the Remcor QA officer and attempt to resolve the discrepancies. All communications is documented.

F.12.2.2 Corrective Action During Analysis

Prior to and during sample analysis, the analyst monitors the analytical system to ensure that the elements crucial to producing data of acceptable quality (tune, initial calibration, calibration verification, method

(blank results, results or matrix spike/matrix spike duplicate analyses, etc.) meet the specified criteria. If a criterion is not met, the analyst takes the appropriate corrective action, and documents the event and the corrective actions in the analysis log. During daily data review, the group leader reviews the raw data to ensure that the corrective action taken was appropriate and sufficient. If the corrective action taken by the analyst was satisfactory, the group leader approves the data. If the corrective action was insufficient, the group leader indicates this in the analysis log and directs the additional corrective action. The additional corrective measures are also documented on the record.

F.12.2.3 Corrective Action During Data Review

(The laboratory group leader reviews data for completed analyses daily, double-checking identification and quantitation of target parameters, and ensuring that QC checks are made at the appropriate frequency and that they meet the specified criteria. If a problem is found during review, the group leader indicates same in the analysis log and directs the appropriate corrective action.

APPENDIX F
TABLES

TABLE F-1
ANALYTICAL PROCEDURES
QUALITY ASSURANCE PROJECT PLAN

SOIL SAMPLES

PARAMETER	EXTRACTION METHOD	ANALYTICAL METHOD
Total Lead	Not applicable	7420 or 6010
Extraction Procedure Toxicity Lead	1310	7420
Priority Pollutant Volatile Organics	8240	8240

WATER SAMPLES

PARAMETER	ANALYTICAL METHOD
Priority Pollutant Volatile Organics	8240
Total Lead	7420 or 6010
Nitrate	9200
Phenolics	9066

NOTE: All methods refer to U.S. Environmental Protection Agency (EPA) SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," November 1986.

TABLE P-2
CALIBRATION AND QUALITY CONTROL CHECKS FOR INORGANIC PARAMETERS
QUALITY ASSURANCE PROJECT PLAN

INORGANIC CHEMISTRY TESTS	INITIAL CALIBRATION(1)	CONTINUING CALIBRATION	CALIBRATION		PREPARATION BLANK	LABORATORY CONTROL STANDARD	DUPLICATE	MATRIX SPIKE
			BLANK	BLANK				
Alkalinity/ Acidity	M	X	-	-	-	-	X	-
pH	D	X	-	-	-	-	X	-
Specific Conductance	D	X	-	-	-	-	X	-
Nitrate	D	X	X	-	-	-	X	X

(1) Calibration key: D = Daily; M = Monthly; X = Applicable QC sample.

APPENDIX F
REFERENCES

APPENDIX F
LIST OF REFERENCES

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APPENDIX G
HEALTH AND SAFETY PLAN

APPENDIX G
HEALTH AND SAFETY PLAN

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APPENDIX G
HEALTH AND SAFETY PLAN
REMEDATION ACTIVITIES
NORTH END LANDFILL
ARMCO INC.
KANSAS CITY, MISSOURI

G.1.0 INTRODUCTION

This Health and Safety Plan describes the program to be implemented by Remcor, Inc. (Remcor) during remediation activities at the Union Wire Rope (UWR) facilities in Kansas City, Missouri. The objective of this plan is to provide site-specific procedures to protect the health and safety of personnel during the conduct of this project and to mitigate the potential for off-site release of contaminants. All work will be performed in accordance with applicable federal, state, and local regulations, including:

- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) - 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926
- U.S. Environmental Protection Agency (EPA) - 40 CFR 260 to 267.

The health and safety practices, procedures, and personal protective equipment are based on site characterization and hazard assessment. Site characterization and hazard assessment are ongoing activities, and the level of protective procedures and practices will be continuously evaluated during the conduct of this work to provide a safe working environment. All protective measures employed will be commensurate with hazards associated with specific work activities and job tasks.

All personnel will be adequately trained in health and safety aspects of their specific job assignments and in all aspects of this plan, including:

- Program organization and responsibilities
- Site characterization and hazard assessment
- Medical surveillance requirements

- Work practices and site control
- Personal protective equipment
- Monitoring
- Materials handling and decontamination
- Emergency response
- Recordkeeping.

G.2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

The design and implementation of the health and safety plan are accomplished through an integral team effort of the following:

- Remcor Project Manager - Responsible for all project activities including continuous adherence to and implementation of the site health and safety plan
- Corporate Health and Safety Officer - Responsible for general development and administration of the site health and safety plan and monitoring of compliance with the plan
- On-Site Project Supervisor - Responsible for executing project requirements on site, including health and safety requirements
- On-Site Health and Safety Officer - Responsible for field implementation and day-to-day operation of the health and safety plan
- All employees, including subcontract employees, are required to be familiar with and comply with the health and safety plan. Personnel are encouraged to offer ideas, suggestions, or recommendations regarding operational conditions, procedures, or practices that may enhance the health and safety of affected personnel.

G.3.0 HAZARD ASSESSMENT

This chapter describes the potential hazards associated with this site. Hazards may be either chemical or physical and each is discussed separately below.

G.3.1 CHEMICAL HAZARDS

The primary chemical hazard of concern is lead in the form of dust. This hazard is associated primarily with activities at the North End landfill.

G.3.1.1 North End Landfill Remediation Activities

The hazard of concern is metallic lead dust. Metallic lead dust can enter the body two ways, through inhalation and ingestion.

Long-term overexposure to lead may result in damage to the reproductive, blood forming, urinary, and nervous systems. Symptoms of long-term overexposure include excessive tiredness, weakness, insomnia, headaches, loss of appetite, numbness, dizziness, etc.

Short-term overexposure may result in encephalopathy, seizures, and coma. Attachment 1 contains a Material Safety Data Sheet (MSDS) on lead. The permissible exposure limit (PEL) for lead is 50 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Air monitoring will be performed as outlined in Chapter G.7.0.

G.3.2 PHYSICAL HAZARDS

Physical hazards exist from the rubble (particularly wire scrap) mixed in with the soil and the operation of heavy equipment.

During soil excavation, the wire can become exposed and cut personnel, puncture tires on equipment, and cause tripping hazards. Care will be taken to keep unnecessary personnel clear of the area where excavation is taking place.

(There are physical hazards on this site associated with the operation of excavating and drilling equipment. All equipment will have equipment checks performed at the beginning of each day. The equipment check will be performed by an equipment operator familiar with the equipment. The equipment check will be logged in the daily log, and any deficiencies noted will be corrected before work can begin. Only operators trained, qualified, and authorized by the Site Supervisor will be permitted to operate the equipment.

Hand signals will be prearranged between the equipment operator and personnel working in and around the equipment. Personnel non-essential to the operation of the equipment and excavating area will maintain a safe working distance from the equipment; this distance will be determined by the Site Supervisor.

Additional hazards associated with drilling operations include the potential presence of volatile organic compounds (VOCs). Standard procedures for drilling operations includes periodic monitoring of boreholes for VOCs and explosive vapors as outlined in Chapter G.7.0.

G.4.0 MEDICAL SURVEILLANCE

Medical screening provides a method of identifying those employees whose medical history indicates potentially increased health risk when exposed to chemicals present within the working environment. Medical screening directly and indirectly measures the functional activity or organs affected by potential chemical exposure during the work and includes physiological tests of parameters having a clinical relevance to the potential chemical exposure.

Employees are required to undergo medical examinations in compliance with Remcor's medical surveillance program. This includes a preemployment medical examination and laboratory studies along with an annual re-examination. Each employee whose work involves potential exposure to hazardous materials will have medical screening that includes a complete history and physical examination along with baseline laboratory studies.

The medical surveillance includes a judgment by the examining physician of the ability of the employee to use respirators. Only employees who have successfully completed the Remcor medical surveillance program are cleared to work with hazardous materials.

Baseline blood lead levels will be taken on all personnel assigned to this project before the start of the project and follow-up levels at the end of the project.

G.5.0 WORK PRACTICES AND SITE CONTROL

In order to protect the health and safety of project personnel, safe work practices will be established and implemented for each of the job tasks to be completed. Work practices to mitigate the potential for exposure to hazardous materials includes evaluation of the waste characterization data and selection of appropriate protective clothing to prevent skin contact with hazardous materials.

The buddy system is an integral part of Remcor's safe work practices. All site activities which involve safety hazards and/or the potential for contact with hazardous materials will be performed by a work team of no fewer than two people. For high-hazard activities, an additional person will serve as a watcher or rescue person.

G.5.1 PERSONAL HYGIENE

Administrative procedures require hygienic practices consistent with work hazards. Eating and food preparation is prohibited in any area other than those designated and properly protected. No food or beverages will be permitted in the work area, including items such as candy, gum, snuff, cigarettes, and chewing tobacco.

Employees who handle contaminated materials or articles must wash with soap or mild detergent and water before eating. To avoid potential hand-to-mouth contamination, smoking or carrying of tobacco products is prohibited in the work area. The Site Supervisor will perform inspections and document variations or violations.

The activities required during the conduct of site activities may contribute to the movement of contaminants from the site to unaffected areas. Site personnel and equipment may become contaminated and carry the material into clean areas. To minimize the transfer of hazardous substances from the site due to site activities, contamination control procedures are needed. Two general methods are used:

- Establishing site work zones
- Establishing decontamination procedures.

A site must be controlled to reduce the possibility of exposure to any contaminants present and their transport by personnel or equipment from the site.

The possibility of exposure or transfer of contaminated substances can be reduced or eliminated in a number of ways, including:

- Setting up barriers to exclude unnecessary personnel from contaminated areas
- Minimizing the number of personnel and equipment at the site
- Establishing work zones within the site
- Establishing control points with regular access to and egress from work zones
- Conducting operations in a manner to reduce exposure of personnel and equipment
- Implementing appropriate decontamination procedures.

G.5.2 DELINEATION OF WORK ZONES

One method to prevent or reduce the migration of contamination is to delineate zones on the site where prescribed operations occur. Movement of personnel and equipment between zones and onto the site itself is limited by access control points. By these means, contamination is expected to be contained within certain relatively small areas on the site and its potential for transfer thereby minimized. Three contiguous zones are recommended:

- Zone 1 - Exclusion Zone
- Zone 2 - Contamination Reduction Zone
- Zone 3 - Support Zone.

The establishment of site work zones is dependent upon the location of contamination and the job task to be performed on site. The exclusion zone or hot zone is the area where contamination exists. All personnel

within the exclusion zone must wear the required level of protective gear. Personnel protective equipment is designated on the basis of site specific conditions, including the job task to be performed and the hazard which might be encountered. Occasionally, within the exclusion zone, different levels of protection are justified. The level of protection required is determined by the concentration of contamination present and the job task to be performed.

Adjacent to the exclusion zone is a contamination reduction zone (CRZ), which provides an area of transition between contaminated and clean zones. The CRZ serves as a buffer to reduce the probability of the clean zone becoming contaminated. Decontamination stations for both personnel and equipment are established in the CRZ.

The support zone is a noncontaminated or clean area. Support equipment is located in this zone. Normal work clothes are appropriate within this zone and potentially contaminated personal clothing and equipment and samples are not permitted but are left in the CRZ until they are decontaminated.

The establishment of site work zones will be based on the judgment of the site Health and Safety Officer. Adequate room must be allowed for necessary operations within each zone, and must provide adequate distances to prevent the spread of contamination.

G.6.0 PERSONAL PROTECTIVE EQUIPMENT

The objective of Remcor's protective equipment program is twofold:

- To protect workers from safety and health hazards present at hazardous waste sites
- To prevent injury to workers from incorrect use and/or malfunction of personal protective equipment (PPE).

Anyone entering hazardous waste sites must be protected against potential hazards. The purpose of PPE is to shield or isolate individuals from the chemical, physical, and biological hazards that may be encountered at a hazardous waste site.

No single combination of protective equipment and clothing is capable of protecting against all hazards. Thus, PPE should be used in conjunction with other protective measures such as good work practices. The use of PPE can itself create significant worker hazards, such as heat stress, physical and psychological stress, impaired vision, mobility, and communication. In general, the greater level of PPE protection, the greater the associated risks. For any given work situation, equipment and clothing will be selected to provide an adequate level of protection. Overprotection as well as underprotection can be hazardous and will be avoided.

G.6.1 LEVELS OF PROTECTION

The minimum level of protection for all Remcor workers at active sites includes standard work clothes, hard hats, and safety shoes. Eye protection will be included for tasks such as removing debris, etc., which do not involve chemicals. The Project Manager should consult with Corporate Health and Safety for specific guidance or variance from this requirement.

Personnel must wear protective equipment when work activities involve known or suspected air contamination, when vapors, gases, or particulates may be generated, or when direct contact with skin-affecting

substances may occur. Respirators are used to protect the lungs, gastrointestinal tract, and eyes against air toxicants. Chemical-resistant clothing can protect skin from contact with skin destructive and absorbable materials. Good personal hygiene limits or prevents ingestion of materials.

Equipment to protect the body against contact with chemical hazards is divided into four categories according to the degree of protection accorded:

- Level A - Should be worn when the highest level of respiratory, skin, and eye protection is needed
- Level B - Should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection is needed
- Level C - Should be worn when the types of airborne substances are known, the concentrations have been measured, and the criteria for using air-purifying respirators are met
- Level D - Should not be worn on any site where respiratory or skin hazards are present. Level D is primarily a work uniform providing minimal protection.

The level of protection selected is based primarily on:

- The type, toxicity, and measured concentrations of the chemical substances
- The potential or measured exposure to substances in the air, splashes of liquids, or other direct contact with materials due to the work being performed.

While PPE reduces the potential for contact with harmful substances, ensuring the health and safety of personnel requires, in addition, safe work practices, decontamination, and other safety considerations. Together, these practices establish a combined approach for reducing potential harm to workers.

G.6.2 SPECIFIC LEVEL OF PROTECTION

The initial level of protection will be Level C consisting of:

- Chemical-resistant outer clothing
- Chemical-resistant steel-toe work boots
- Heavy work gloves
- Hard hat
- Safety glasses
- Air-purifying respirator.

The level of protection may be changed depending on air monitoring results as outlined in Chapter G.7.0.

G.7.0 AIR MONITORING

Air quality monitoring is an integral part of the health and safety program; the collected data serves as input to decisions regarding worker protective measures, routine work procedures, and emergency events. The air quality monitoring program requirements will include perimeters and personnel sampling for lead, and sampling of boreholes for VOCs and flammable/explosive vapors.

G.7.1 LEAD SAMPLING

The perimeter sampling will be conducted on a daily basis outside of the buildings to ensure that no contamination is released to the outside.

Personnel sampling will be conducted to assure that a good cross section of personnel is obtained. Approximately 10 personnel samples will be taken. Samples will be taken over the full shift.

Equipment to be used for the air sampling will consist of:

- Portable sampling pumps
- Calibrator
- 37-millimeter filter cassettes with 0.8-micron cellulose ester filters
- Tygon sample tubing.

All samples must be sent out for laboratory analysis. Initially, the first few samples will be sent for a quick turnaround to determine airborne concentration. The rest will be on a normal turnaround time.

G.7.2 VOC AND EXPLOSIVITY MONITORING

During drilling operations, boreholes will be periodically monitored for VOC and flammable/explosive vapors using appropriate direct-reading instruments. If VOC levels are detected at the borehole, readings will be taken in the breathing zone of drill rig operators. A sustained (>15 minutes) breathing zone concentration of VOC at 25 parts per million

((ppm) or more will necessitate suspension of drilling activities and evaluation of the situation by the site health and safety officer. Similarly, if the lower explosive limit (LEL) in the borehole reaches or exceeds 25 percent, drilling operations will be suspended and conditions re-evaluated. Drilling will resume only after appropriate actions have reduced the LEL below 25 percent.

All monitoring results will be documented using form HS-12, Attachment 2.

G.8.0 MATERIAL HANDLING AND DECONTAMINATION

All waste material, decontamination solvents, and decontamination equipment will be handled in a safe and healthful manner. When applicable, decontamination activities will be carried out within the appropriate work zones:

- Exclusion Zone (Hot Zone) - This is defined as the area where the greatest potential for personnel exposure exists.
- Contamination Reduction Zone - This zone is defined as the area adjacent to the hot zone and has a reduced potential for exposure. In this area, personnel will doff protective clothing in a manner as to minimize potential contamination via skin contact, inhalation, or ingestion. Gross contamination will be cleaned from protective clothing prior to removal. Wash water and contaminated material will be collected and disposed of properly.
- Support Zone (Clean Zone) - This is defined as the area in which no known potential contamination exists. Operation support activities shall be set up in this area. There should be no need for protective clothing to be worn in this area.

G.9.0 EMERGENCY PROCEDURES

The health and safety program for the project has been established to allow site operations to be conducted without adverse impacts on worker health and safety. In addition, supplementary emergency response procedures have been developed to cover extraordinary conditions that might possibly occur at the site.

G.9.1 GENERAL

All accidents and unusual events will be dealt with in a manner to minimize continued health risk of site workers. In the event that an accident or other unusual event occurs, the following procedure will be followed:

- First aid or other appropriate initial action will be administered by those closest to the accident/unusual event. This assistance will be conducted in a manner to assure that those rendering assistance are not placed in a situation of unacceptable risk.
- All accidents/unusual events must be reported to the Site Supervisor. The Site Supervisor is responsible for conducting the emergency response in an efficient, rapid, and safe manner. He will decide if off-site assistance and/or medical treatment is required and arrange for assistance.
- All workers on site are responsible to conduct themselves in a mature, calm manner in the event of an accident/unusual event. All personnel must conduct themselves in a manner to avoid spreading the danger to themselves and to surrounding workers.

The following emergency equipment will be available at the site:

- First-aid kit
- Fire extinguisher
- Emergency eyewash station.

The Site Supervisor will be responsible for documenting all accidents/injuries.

G.9.2 RESPONSES TO SPECIFIC SITUATIONS

Emergency procedures for specific situations are given in the following paragraphs.

G.9.2.1 Worker Injury

If an employee working in a contaminated area is physically injured, Red Cross first-aid procedures will be followed. Depending on the severity of the injury, emergency medical response may be sought. If the employee can be moved, he will be taken to the edge of the work area (on a stretcher, if needed) where contaminated clothing will be removed, emergency first aid administered, and transportation to a local emergency medical facility awaited. Emergency telephone numbers will be posted on site.

If the injury to the worker is chemical in nature (e.g., overexposure), the following first-aid procedures are to be instituted:

- Eye Exposure - If contaminated solid or liquid gets into the eyes, wash eyes immediately at the emergency eyewash station using large amounts of water and lifting the lower and upper lids occasionally. Obtain medical attention immediately. Contact lenses are not to be worn when working.
- Skin Exposure - If contaminated solid or liquid gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If solids or liquids penetrate through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Obtain medical attention immediately.
- Swallowing - If contaminated solid or liquid has been swallowed and the person is conscious, give the person large quantities of salt water immediately and induce vomiting. Do not make an unconscious person vomit. Obtain medical attention immediately if signs of overexposure develop.
- Breathing - If a person breathes in large amounts of organic vapor, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

G.9.2.2 Fires

Fire extinguishers will be provided on site. If a localized fire breaks out, chemical fire extinguishers will be used to bring the occurrence under control. If necessary and feasible, soil or other inert materials will be placed on the burning area to extinguish the flames and minimize the potential for spreading. If appropriate, local fire-fighting authorities will be contacted for notification and/or assistance.

If an uncontrolled fire develops releasing potentially toxic gases, persons in the immediate vicinity will be evacuated. Only personnel trained in fire-fighting and outfitted with proper protective equipment will be allowed in the immediate fire area. The Site Supervisor will alert local fire-fighting companies.

G.9.3 PUBLIC RESPONSE AGENCIES

Following is a list of public response agencies that may be contacted dependent on the nature of the situation. They may assume authority for emergency response. In the event that this occurs, Armco personnel will assist the agency in charge. Telephone numbers for the listed agencies will be posted in all Remcor vehicles on site:

<u>Agency</u>	<u>Telephone No.</u>
• Fire	911/842-2121
• Police	911/421-1500
• Ambulance	911/471-1111
• Independence Regional Health Center	816-836-8100

G.10.0 RECORDKEEPING

All site health and safety activities will be properly documented using forms contained in Attachment 2. In addition, the following notification and records will be posted on site:

- OSHA poster
- OSHA 200 form
- Equal opportunity employment poster.

Any unusual events will be recorded on the site daily log.

G.11.0 TRAINING

All Remcor employees have received hazardous waste operations training in compliance with OSHA regulations. In addition, site employees will receive an initial health and safety briefing and regular on-site training during the course of this project.

Initial training will cover this health and safety plan. Additional training sessions will deal with specific job-related tasks. All training sessions will be documented using Form HS-3 (Attachment 2).

ATTACHMENT 1
MATERIAL SAFETY DATA SHEETS

Summary

Lead is a heavy metal that exists in one of three oxidation states, 0, +2, and +4. There is suggestive evidence that some lead salts are carcinogenic, inducing kidney tumors in mice and rats. Lead is also a reproductive hazard, and it can adversely affect the brain and central nervous system by causing encephalopathy and peripheral neuropathy. Chronic exposure to low levels of lead can cause subtle learning disabilities in children. Exposure to lead can also cause kidney damage and anemia, and it may have adverse effects on the immune system.

CAS Number: 7439-92-1

Chemical Formula: Pb

IUPAC Name: Lead

Chemical and Physical Properties

Atomic Weight: 207.19

Boiling Point: 1,740°C

Melting Point: 327.502°C

Specific Gravity: 11.35 at 20°C

Solubility in Water: Insoluble; some organic compounds are soluble

Solubility in Organics: Soluble in HNO_3 and hot, concentrated H_2SO_4

Transport and Fate

Some industrially produced lead compounds are readily soluble in water (USEPA 1979). However, metallic lead and the common lead minerals are insoluble in water. Natural compounds of lead are not usually mobile in normal surface or groundwater because the lead leached from ores is adsorbed by ferric hydroxide or combines with carbonate or sulfate ions to form insoluble compounds.

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Movement of lead and its inorganic and organolead compounds as particulates in the atmosphere is a major environmental transport process. Lead carried in the atmosphere can be removed by either wet or dry deposition. Although little evidence is available concerning the photolysis of lead compounds in natural waters, photolysis in the atmosphere occurs readily. These atmospheric processes are important in determining the form of lead entering aquatic and terrestrial systems.

The transport of lead in the aquatic environment is influenced by the speciation of the ion. Lead exists mainly as the divalent cation in most unpolluted waters and becomes adsorbed into particulate phases. However, in polluted waters organic complexation is most important. Volatilization of lead compounds probably is not important in most aquatic environments.

Sorption processes appear to exert a dominant effect on the distribution of lead in the environment. Adsorption to inorganic solids, organic materials, and hydrous iron and manganese oxides usually controls the mobility of lead and results in a strong partitioning of lead to the bed sediments in aquatic systems. The sorption mechanism most important in a particular system varies with geological setting, pH, Eh, availability of ligands, dissolved and particulate ion concentrations, salinity, and chemical composition. The equilibrium solubility of lead with carbonate, sulfate, and sulfide is low. Over most of the normal pH range, lead carbonate, and lead sulfate control solubility of lead in aerobic conditions, and lead sulfide and the metal control solubility in anaerobic conditions. Lead is strongly complexed to organic materials present in aquatic systems and soil. Lead in soil is not easily taken up by plants, and therefore its availability to terrestrial organisms is somewhat limited.

Bioaccumulation of lead has been demonstrated for a variety of organisms, and bioconcentration factors are within the range of 100-1,000. Microcosm studies indicate that lead is not biomagnified through the food chain. Biomethylation of lead by microorganisms can remobilize lead to the environment. The ultimate sink of lead is probably the deep oceans.

Health Effects

There is evidence that several lead salts are carcinogenic in mice or rats, causing tumors of the kidneys after either oral or parenteral administration. Data concerning the carcinogenicity of lead in humans are inconclusive. The available data are not sufficient to evaluate the carcinogenicity of organic lead compounds or metallic lead. There is equivocal evidence that exposure to lead causes genotoxicity in humans and animals. The available evidence indicates that lead presents

a hazard to reproduction and exerts a toxic effect on conception, pregnancy, and the fetus in humans and experimental animals (USEPA 1977, 1980).

Many lead compounds are sufficiently soluble in body fluids to be toxic (USEPA 1977, 1980). Exposure of humans or experimental animals to lead can result in toxic effects in the brain and central nervous system, the peripheral nervous system, the kidneys, and the hematopoietic system. Chronic exposure to inorganic lead by ingestion or inhalation can cause lead encephalopathy, and severe cases can result in permanent brain damage. Lead poisoning may cause peripheral neuropathy in adults and children, and permanent learning disabilities that are clinically undetectable in children may be caused by exposure to relatively low levels. Short-term exposure to lead can cause reversible kidney damage, but prolonged exposure at high concentrations may result in progressive kidney damage and possibly kidney failure. Anemia, due to inhibition of hemoglobin synthesis and a reduction in the life span of circulating red blood cells, is an early manifestation of lead poisoning. Several studies with experimental animals suggest that lead may interfere with various aspects of the immune response.

Toxicity to Wildlife and Domestic Animals

Freshwater vertebrates and invertebrates are more sensitive to lead in soft water than in hard water (USEPA 1980, 1983). At a hardness of about 50 mg/liter CaCO_3 , the median effect concentrations for nine families range from 140 $\mu\text{g/liter}$ to 236,600 $\mu\text{g/liter}$. Chronic values for Daphnia magna and the rainbow trout are 12.26 and 83.08 $\mu\text{g/liter}$, respectively, at a hardness of about 50 mg/liter. Acute-chronic ratios calculated for three freshwater species ranged from 18 to 62. Bioconcentration factors, ranging from 42 for young brook trout to 1,700 for a snail, were reported. Freshwater algae show an inhibition of growth at concentrations above 500 $\mu\text{g/liter}$.

Acute values for twelve saltwater species range from 476 $\mu\text{g/liter}$ for the common mussel to 27,000 $\mu\text{g/liter}$ for the soft-shell clam. Chronic exposure to lead causes adverse effects in mysid shrimp at 37 $\mu\text{g/liter}$, but not at 17 $\mu\text{g/liter}$. The acute-chronic ratio for this species is 118. Reported bioconcentration factors range from 17.5 for the Quahog clam to 2,570 for the blue mussel. Saltwater algae are adversely affected at approximate lead concentrations as low as 15.8 $\mu\text{g/liter}$.

Although lead is known to occur in the tissue of many free-living wild animals, including birds, mammals, fishes, and invertebrates, reports of poisoning usually involve waterfowl. There is evidence that lead, at concentrations occasionally found near roadsides and smelters, can eliminate or reduce

populations of bacteria and fungi on leaf surfaces and in soil. Many of these microorganisms play key roles in the decomposer food chain.

Cases of lead poisoning have been reported for a variety of domestic animals, including cattle, horses, dogs, and cats. Several types of anthropogenic sources are cited as the source of lead in these reports. Because of their curiosity and their indiscriminate eating habits, cattle experience the greatest incidence of lead toxicity among domestic animals.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life (Proposed Criteria)

The concentrations below are for active lead, which is defined as the lead that passes through a 0.45- μ m membrane filter after the sample is acidified to pH 4 with nitric acid.

Freshwater

Acute toxicity: $e^{(1.34 [\ln(\text{hardness})] - 2.014)}$ μ g/liter

Chronic toxicity: $e^{(1.34 [\ln(\text{hardness})] - 5.245)}$ μ g/lit.

Saltwater

Acute toxicity: 220 μ g/liter

Chronic toxicity: 8.6 μ g/liter

Human Health

Criterion: 50 μ g/liter

Primary Drinking Water Standard: 50 μ g/liter

NIOSH Recommended Standard: 0.10 mg/m³ TWA (inorganic lead)

OSHA Standard: 50 μ g/m³ TWA

ACGIH Threshold Limit Values:

0.15 mg/m³ TWA (inorganic dusts and fumes)

0.45 mg/m³ STEL (inorganic dusts and fumes)

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ATTACHMENT 2
HEALTH AND SAFETY FORMS

JOBSITE SAFETY CHECKLIST

Project _____

Project No. _____ Person Making Inspection _____

Jobsite Location _____

Date of Inspection _____

A. Adequate at time of inspection.
B. Needs immediate attention.

C. Item not applicable.
N/A No items in section applicable.

Check one of the following:

Check one of the following:

A B C

A B C

A. Posters & Records N/A ☐

- | | | | |
|--|--------------------------|--------------------------|--------------------------|
| 1. OSHA poster displayed? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Foremen holding weekly safety meetings — recording? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Emergency medical numbers posted? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Explosives inventory current? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Copy of OSHA regulations on jobsite? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Have utility contacts been made/recorded? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Are safety talk subjects available? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Blank accident report forms available? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Using Employment Applications before hiring? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Are Safety posters being displayed? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

J. Housekeeping & Sanitation N/A ☐

- | | | | |
|--|--------------------------|--------------------------|--------------------------|
| 11. General housekeeping of jobsite? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. Passageways and walkways clear? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Nails removed from lumber? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Materials of all types properly stockpiled? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Is an area provided for waste and trash and is it removed regularly? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. Adequate lighting in passageways, stairways and work areas? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17. Toilet facilities adequate and clean? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. Sanitary supply of drinking water? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. Disposable drinking cups and refuse container? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. Means provided for sanitizing personal protective equipment? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

C. Fire Protection N/A ☐

- | | | | |
|--|--------------------------|--------------------------|--------------------------|
| 21. Are "No Smoking" or "Flammable" signs posted at all storage and fueling locations? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. Clear access provided to all fire fighting equipment/are inspections recorded? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. Location of all fire fighting equipment prominently marked? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. Are flammable liquids stored in approved containers? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. Fire extinguishers adequate size? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26. Large fuel tanks properly diked and separated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

D. First Aid N/A ☐

- | | | | |
|--------------------------------------|--------------------------|--------------------------|--------------------------|
| 27. First Aid Kits well stocked? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. Trained first-aiders on jobsite? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

E. Electrical N/A ☐

- | | | | |
|---|--------------------------|--------------------------|--------------------------|
| 29. Distribution boxes covered or marked? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. GFI's in use or positive grounding been tested? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31. Temporary lighting protected? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

F. Tools N/A ☐

- | | | | |
|---|--------------------------|--------------------------|--------------------------|
| 32. Damaged or broken tools tagged out of service? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33. Proper storage space provided? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34. Operative guards on all power tools? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35. Persons using powder actuated tools certified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36. Are guards provided on grinders? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37. Airhose couplers secured or safety valve in line? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38. Tools being properly used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39. Correct personal protection being used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40. Extension cords tested for assured ground? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

G. Structures N/A ☐

- | | | | |
|---|--------------------------|--------------------------|--------------------------|
| 41. Floor openings covered or guardrailed? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 42. Standard guardrailing on scaffolds, bridge decks, floors of buildings, work platforms and walkways? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 43. Work areas clear of debris, snow, ice, and grease? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 44. Adequate fire protection? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 45. Stairways provided with handrails? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 46. Hollow pan-treads filled with solid material? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 47. Ladders properly constructed? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 48. Side rails of ladders extend 36" above landing? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 49. Scaffolds properly anchored, braced and plumb? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 50. Protection provided over vertical rebars when working above? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 51. Safety belts in use when guardrails are absent? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 52. Employees clear of swinging crane loads? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 53. Tag lines used on suspended crane loads? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 54. Gas cylinders separated, secured upright and capped if not in use? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 55. Safety lines in use on suspended scaffolds? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 56. Heating devices properly ventilated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 57. Gates functioning on all levels when material or personnel hoists used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 58. Safe procedures being used to wreck forms? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



A. Adequate at time of inspection.
B. Needs immediate attention.

C. Item not applicable
N/A No items in section applicable.

Check one of the following:

A B C

H. Traffic Control N/A ☐

59. Advance signing at approaches to work areas? ☐ ☐ ☐
60. Correct message on signs? ☐ ☐ ☐
61. Traffic control set-up on highways meet ODOT regulations? ☐ ☐ ☐
62. Flag persons properly dressed and equipped? ☐ ☐ ☐
63. Flag persons performing properly? ☐ ☐ ☐

I. Welding & Cutting N/A ☐

64. Using right type eye protection? ☐ ☐ ☐
65. Gages, valves, torches and lines in good condition and free of oil and grease? ☐ ☐ ☐
66. Cylinders not in use capped? ☐ ☐ ☐
67. Cylinders in use or storage secured up-right? ☐ ☐ ☐
68. Anti-flashback valves at torch? ☐ ☐ ☐
69. Stored oxygen separated from acetylene by 20 ft.? ☐ ☐ ☐
70. Fire extinguisher near welding or cutting operations? ☐ ☐ ☐
71. Adequate ventilation provided? ☐ ☐ ☐
72. Grounding for arc welding machine? ☐ ☐ ☐
73. All parts of arc welding outfits properly insulated? ☐ ☐ ☐

J. Heavy Equipment N/A ☐

74. Operators wearing hard hats? ☐ ☐ ☐
75. Hearing protection being used? ☐ ☐ ☐
76. Dust Control? ☐ ☐ ☐
77. Haul road adequate and maintained? ☐ ☐ ☐
78. Equipment speeds excessive for safety? ☐ ☐ ☐
79. Horns and back-up alarms functioning? ☐ ☐ ☐
80. Clearing cabs on machines when clearing? ☐ ☐ ☐
81. Engines shut-down when refueling or lubricating? ☐ ☐ ☐
82. Seat belts on machines with ROPS? ☐ ☐ ☐
83. Steps and hand holds adequate and safe condition? ☐ ☐ ☐
84. Adequate lighting of haul roads at night? ☐ ☐ ☐
85. Parked or unattended equipment have blade lowered to the ground? ☐ ☐ ☐
86. No hitchhikers riding on equipment? ☐ ☐ ☐
87. Full fire extinguisher near refueling tank? ☐ ☐ ☐
88. Dump man prominently located? ☐ ☐ ☐
89. Overhead guard on fork lift truck? ☐ ☐ ☐
90. Vehicles with restricted rear visibility equipped with operating back-up alarms? ☐ ☐ ☐

K. Cranes N/A ☐

91. Power line distance from machines? ☐ ☐ ☐
92. Annual inspection? ☐ ☐ ☐
93. Cables in safe condition? ☐ ☐ ☐
94. Rear swing protection and pinch point guarding? ☐ ☐ ☐
95. Exposed gears, shafts and belts guarded? ☐ ☐ ☐
96. Fire extinguisher, boom angle indicator, load capacity chart and hand signal poster in crane? ☐ ☐ ☐
97. Signs and/or flags on cranes in transit? ☐ ☐ ☐
98. Operator making daily inspections and tests? ☐ ☐ ☐

Trenching & Excavations N/A ☐

99. Trench side shored, layed back or boxed? ☐ ☐ ☐
100. Utilities contacted and located before digging? ☐ ☐ ☐
101. Ladder in the trench? ☐ ☐ ☐
102. Stop logs placed where necessary along top of the trench? ☐ ☐ ☐

Check one of the following:

A B C

103. Excavated material stockpiled far enough from the edge of the trench? ☐ ☐ ☐
104. Laser warning signs in place? ☐ ☐ ☐
105. Adequate ventilation in pipe? ☐ ☐ ☐
106. Traffic control adequate? ☐ ☐ ☐
107. Sides of excavation for building shored or protected? ☐ ☐ ☐
108. Oxygen level tested in tunnel, shafts or confined space? ☐ ☐ ☐
109. Public protected from exposure to open excavation? ☐ ☐ ☐

M. Miscellaneous N/A ☐

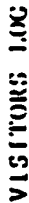
110. Sufficient quantities of approved personal protective equipment on the jobsite? ☐ ☐ ☐
111. Procedures established to handle toxic and carcinogenic materials? ☐ ☐ ☐
112. Sewers, vaults, tanks and bins tested for adequate oxygen levels before employees are permitted to enter? ☐ ☐ ☐
113. Everyone wearing hard hat? ☐ ☐ ☐
114. Fall protection being used on steel erection? ☐ ☐ ☐
115. Walls properly braced (concrete and block construction)? ☐ ☐ ☐
116. Toxic fumes, vapors and dusts present, is ventilation adequate? ☐ ☐ ☐
117. Guards in place and used on wood working machines? ☐ ☐ ☐
118. Explosives being used, transported and stored in compliance with regulations? ☐ ☐ ☐
119. Blaster following all safety precautions? ☐ ☐ ☐
120. Tunneling operations/lighting and ventilation adequate? ☐ ☐ ☐
121. Belts, pulleys, shafts, gears and chains guarded on all machinery and equipment? ☐ ☐ ☐
122. Masonry saws grounded and personal protective equipment being used? ☐ ☐ ☐
123. Exit signs over doors in offices and storage buildings? ☐ ☐ ☐

*This checklist does not include all hazards on every job, but is intended to remind you of most common hazards.

Unsafe acts and/or practices observed:

I the undersigned superintendent have reviewed the indicated hazards and will take the necessary action to immediately correct them.

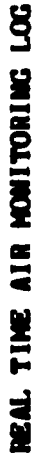
Signature of Project Supervisor



Project Name:

Project Number:

[illegible]



SITE: _____ PROJECT NO. _____
INSTRUMENT: _____ SERIAL NO.: _____ CALIBRATION DATE: _____

[illegible]

Signature Site Super Indendent: _____

APPENDIX H
DEVELOPMENT OF CLEANUP STANDARDS
LEAD CONCENTRATIONS IN SOILS

APPENDIX H
DEVELOPMENT OF CLEANUP STANDARDS
LEAD CONCENTRATIONS IN SOILS

This appendix presents the standards for acceptable total lead concentrations in soils to be applied in the waste removal action at the North End former disposal area. These cleanup levels have been developed to assure accomplishment of the project objectives set forth in Section 1.2; standards have been specifically derived to achieve the following:

- Eliminate hazardous waste from the site
- Protect ground water
- Minimize potential exposure of future users of the site.

Lead has been identified as the hazardous constituent of concern in the wastes and associated contaminated soils at the site. Lead is the only contaminant present in sufficient concentrations to render certain wastes characteristically hazardous and to present a potential future exposure risk.

HAZARDOUS WASTE ELIMINATION

Assurance that EP toxic hazardous waste is eliminated from the site will be achieved by the following:

- Removing all visibly identifiable wastes (e.g., black dusts, scale) and soil/waste mixtures
- Testing residual soils and removing any materials whose total lead concentration exceeds 3,300 $\mu\text{g/g}$.

As described in Section 2.3.3.1, samples of wastes and subsoils from the North End area were analyzed for their total lead content and for EP toxicity metals. The materials exhibiting the characteristic of EP toxic hazardous waste were clearly distinctive (visually) from residual soils.

The statistical evaluation of the developed site data is summarized in Figure 6. As indicated in this figure, a total lead concentration of

3,300 $\mu\text{g/g}$ represents the 95-percent upper prediction limit for the developed relationship at an EP toxicity leachate lead concentration of 5.0 mg/l. The site-specific data evaluation predicts that there is less than a five-percent probability that any site waste or soil containing 3,300 $\mu\text{g/g}$ or less total lead would exhibit the characteristic of EP toxic hazardous waste.

GROUND WATER PROTECTION

Protection of ground water from lead contamination is a secondary concern for the waste removal activities at the North End former disposal area. Ground water is not a significant pathway for potential off-site or on-site lead exposure so that no specific cleanup standard for total lead concentrations in soil is applicable for ground water protection.

Hydrogeologic data developed to date suggest site ground water discharges to the adjacent Blue River. This discharge constitutes a small fraction of the flow in the river so that lead levels in site ground water would have to be very high to have a measurable effect on river water quality. Also, no shallow ground water wells are known to exist within one mile of the UWR site. The potential for significant exposures to off-site local users of ground water is minimal.

Potential risks to future users of on-site ground water similarly appear to be quite limited. In that portion of the site within the proposed COE rechannelization limits, future on-site ground water use is not plausible. In remaining site areas, future site ground water use is considered highly unlikely due to the availability of the municipal water supply for potable water.

Currently available site data also suggest that the wastes are not likely to pose a significant threat of lead contamination of on-site ground water. Factors leading to this interim conclusion follow:

- Data from existing site wells show total lead levels in compliance with primary drinking water standards in ground water adjacent to (generally upgradient of) the formerly

used disposal area. No detectable concentrations of dissolved lead were found in ground water samples taken from these wells in September 1989.

- The site wastes are entirely within the unsaturated zone above the water table and are underlain by clay or silty clay soils.
- Testing of total and EP toxicity lead levels demonstrated that the lead present in the waste is in a relatively insoluble form.

The scope of work for the removal action includes additional ground water studies that will define lead contamination conditions downgradient of the North End former disposal area. These studies will be conducted after completion of waste removal. If significant lead contamination is encountered, Armco will evaluate necessary corrective measures at that time.

PROTECTION OF FUTURE SITE USERS

The waste removal action at the North End is designed to minimize potential risks associated with potential future land uses. The following sections evaluate attendant future site risks.

Rechannelization Area

In the area designated for rechannelization of the Blue River, the site will become part of the permanent right-of-way for the river. The physical configuration of this area will be a sloped riverbank covered with riprap. Development of this area for any permanent use is highly unlikely.

Persons potentially at risk from residual lead contamination include construction workers involved in the rechannelization work. For such workers, the primary route of exposure is inhalation of lead-contaminated dusts.

A worst case, yet plausible, scenario was developed to quantify the potential risk from airborne lead-containing dust during rechannelization

work on the Blue River. This scenario considers a construction worker standing or working immediately downwind of the former disposal area while this area is being regraded. The acceptable lead concentration from this scenario is calculated from the following:

- Rate of respirable dust emissions
- Resultant airborne dust concentration at the receptor
- Comparison of dust concentration to acceptable workplace airborne lead levels.

The rate of respirable (10 micron [μ] size and below) dust generated from earthmoving operations can be estimated from published emission factors for surface mining activities. Fugitive dusts from regrading by a bulldozer, which is a likely operation in the Blue River rechannelization, are estimated by the following equation (U.S. Environmental Protection Agency, 1983):

$$E = \frac{9.89 s^{1.2}}{w^{1.3}}$$

where:

E = respirable ($\leq 10 \mu$) particulate emission rate, grams per second (g/sec)

s = soil silt content, estimated to be 50 percent for site subsoils

w = soil volumetric water content, estimated to be 40 percent for site subsoil in the vadose zone.

For site conditions, the particulate emission rate is calculated to be 8.9 g/sec.

Resultant airborne concentrations can be determined using the near-field box model, which is applicable to receptors very near the emission source (Horst, 1979; Pasquill, 1975). This model is defined as follows:

$$C = \frac{E \times 10^3}{H \cdot W \cdot U}$$

where:

C = airborne concentration at receptor, milligrams per cubic meter (mg/m^3)

H = downwind height of mixing, meters (m)

W = crosswind dimension of box, m

U = average wind speed throughout mixing height, meters per second (m/sec).

The emission area of the box corresponds to that portion of the North End area subject to rechannelization (Figure 3). This area is estimated to be approximately 100 m long ($L = 100$ m) and 30 m wide ($W = 30$ m). Work by Horst (1979) and Pasquill (1975) show that for $L = 100$ m, the downwind height of mixing is 6.2 m ($H = 6.2$ m). The average wind speed is taken from climatological data for Kansas City, Missouri, in which the reported average wind speed (recorded at 10 m height) is 4.6 m/sec (U.S. Department of Commerce, 1978). To adjust the 10-m wind speed (U_{10}) to the average wind speed in the near-field mixing zone, the following equation is used (Horst, 1979; Pasquill, 1975):

$$U = (0.22 U_{10}) \ln (2.5 H).$$

For site conditions with a particulate emission rate of 8.9 g/sec, the airborne respirable particulate concentration is calculated to be 17 mg/m^3 .

The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) standard for allowable airborne lead in the workplace, based on 40-hour per week exposure, is 0.050 mg/m^3 . With a total respirable particulate concentration of 17 mg/m^3 , the OSHA standard is achieved for total lead concentrations of 2,900 $\mu\text{g}/\text{g}$ or less. This concentration can then be taken as the cleanup standard required to protect future site workers for soils within the rechannelization area.

Area Not Used for Rechannalization

Approximately 60 percent of the North End area lies south of the area planned for use in the Blue River rechannalization. This section of the site could be developed in the future for industrial use, and the removal action is designed to restore the site for this potential use (Section 1.2). Future residential or agricultural use of this area is highly unlikely for the following reasons:

- The site area is small (about 1.0 to 1.5 acres) and adjoins undevelopable acreages (i.e., river, railroad tracks, major thoroughfare) on three sides.
- The site lies within the floodplain of the Blue River.
- The site is essentially landlocked by industrial property and has no direct street access.
- Land uses in nearby areas (e.g., former pole treating plant, junkyards, closed and operating industrial plants) suggest that the site is unattractive for residential development.

Potential risks posed by residual lead levels were evaluated for the site on the basis of future commercial or industrial use.

The developed exposure scenarios are intended to present worst-case situations by including all exposure routes (e.g., ingestion, inhalation, and dermal absorption) for both those potential receptors who are likely to be exposed most often and the most-sensitive individuals. The first scenario considers the potential receptors as those adults working in the North End former disposal area. The area is assumed to be used (as it was most recently) as a materials handling area with an unpaved surface. The second scenario assumes that children, the most-sensitive potential receptors, will intrude onto the property to play on a regular basis. Exposure to the soil by ingestion, inhalation, and dermal absorption is evaluated for each scenario. Table H-1 presents the assumptions used for estimating exposure for both scenarios; all references are indicated.

The industrial receptor is an adult male (70 kg body weight) who would work in the area of the North End former disposal area for two hours each workday. It is assumed that his work activity (e.g., forklift operator) would create dusty conditions that would cause him to be exposed by all routes. The body surface exposed is assumed to be 10 percent of the total average body surface. The respiration rate assumed ($1.3 \text{ m}^3/\text{hr}$) is for light work, and 10 mg of soil are assumed to be ingested per day.

The airborne dust concentration is taken to be $3.0 \text{ mg}/\text{m}^3$, which is 20 percent of the OSHA standard for airborne respirable particulate in the workplace. Considering that the OSHA standard was developed primarily for indoor work environments, this particulate concentration for an outdoor environment is considered conservative.

Contaminated soil accumulates on exposed skin at a rate of 0.51 milligram per square centimeter per day ($\text{mg}/\text{cm}^2\text{-day}$) and remains on the skin (before washing) for 12 hours. The amount of lead absorbed from soil through the skin is assumed to be 50 percent of that found by Moore, et al. (1980) to be absorbed from an aqueous solution of lead acetate in 12 hours.

For the intruding child (22 kg body weight; typical 6-year old), the average body surface is much less, but it is assumed that 20 percent of the child's body surface area would be exposed during spring and summer play. The child's respiration rate is slightly higher than the adults ($1.4 \text{ m}^3/\text{hr}$). Assumptions for rates of soil ingestion and accumulation of contaminated soil on exposed skin remain the same. The child's daily activity is one hour per day; this exposure duration is the time spent in the former disposal area and applies only to respiration. Dermal absorption occurs during the entire time the skin is exposed (before washing), which is assumed to be 12 hours. The airborne dust concentration is taken to be $0.075 \text{ mg}/\text{m}^3$, which is the primary National Ambient Air Quality Standard (annual average) for total suspended particulate.

The safe bodily intake of lead for the adult is taken as the EPA-established acceptable chronic intake (AIC) value of 1.4×10^{-3} milligram per kilogram body weight per day (mg/kg-day) (U.S. Environmental Protection Agency, 1986a). This value was established for total intake; absorption within the body from the stomach or lungs is irrelevant in this assessment. Daily intake of lead should not exceed this value for all combined exposure routes. Because of the sensitivity of children to lead exposure and the possibility of other sources of lead intake, this risk assessment uses an adjusted AIC for the child intruder equal to 50 percent of the EPA-established AIC.

The allowable soil-lead concentration is calculated by summing the uptakes for each exposure route and dividing this value into the AIC. These calculations are included in Table H-1.

As shown in Table H-1, total lead concentrations in site soil must be 5,200 mg/kg or less to protect the industrial receptor described by the exposure scenario. To protect the child intruder, the upper limit lead concentration in soil is 1,400 mg/kg.

SUMMARY

In the area proposed for rechannelization of the Blue River, a residual soil lead level of 2,900 mg/kg is required to protect construction workers involved in rechannelization efforts. This value is sufficiently low to assure EP toxic hazardous waste will be eliminated from this portion of the site. In the area south of the rechannelization limit, the controlling lead concentration is that necessary to protect potential future site intruders (children) into an otherwise industrial area. The target lead concentration in soil for this area is 1,400 mg/kg. As a prudent and precautionary approach, based in part on the fact that the final rechannelization limits are not yet defined, a target lead level of 1,400 mg/kg will be used in the removal action.

TABLE

TABLE H-1

CALCULATIONS OF HUMAN UPTAKE OF LEAD
FUTURE SITE USE SCENARIOS

PARAMETER	UNITS	INDUSTRIAL RECEPTOR	INTRUDER RECEPTOR	REFERENCE
BASIC SCENARIO ASSUMPTIONS:				
Body weight	kg	70	22	EPA (1986b)
Total body surface area	cm ²	18,150	9,400	EPA (1988)
Body surface exposed	percent	10.0%	20.0%	EPA (1988)
Inhalation rate	m ³ /hr	1.3	1.4	EPA (1988)
Soil ingestion rate	mg/day	10	10	EPA (1988)
Airborne respirable dust concentration	mg/m ³	3.0	0.075	—
Soil on exposed skin	mg/cm ² -day	0.51	0.51	Lepow, et al. (1975)
Dermal absorption factor	—	0.0015	0.0015	Moore, et al. (1980)
Duration of inhalation exposure	hrs/day	2	1	—
Duration of dermal exposure	hrs/day	12	12	—
EXPOSURE FOR UNIT LEAD CONCENTRATION:				
Ingestion uptake (per mg/kg in soil)	mg/kg-day	1.43E-07	4.55E-07	
Inhalation uptake (per mg/kg in soil)	mg/kg-day	1.11E-07	4.77E-09	
Dermal absorption uptake (per mg/kg in soil)	mg/kg-day	1.98E-08	6.54E-08	
Total daily uptake (per mg/kg in soil)	mg/kg-day	2.74E-07	5.25E-07	
DETERMINATION OF ACCEPTABLE LEAD CONCENTRATIONS IN SOIL:				
Allowable chronic intake	mg/kg-day	1.43E-03	1.43E-03	EPA (1986a)
Soil concentration for exposure equal to allowable chronic intake	mg/kg	5,200	—	
Soil concentration for exposure equal to 50 percent of allowable chronic intake	mg/kg	—	1,400	

APPENDIX H
LIST OF REFERENCES

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APPENDIX H
REFERENCES

North End Site
MOD 985168134
109

ATTACHMENT B
SPECIFICATIONS AND SAMPLE SILT FENCE MATERIAL

Unscanned Document

**This document was unable to be scanned
into SDMS due to its size or construction**

